adi ASSOCIATES ENVIRONMENTAL CONSULTANTS

Scott Wilson

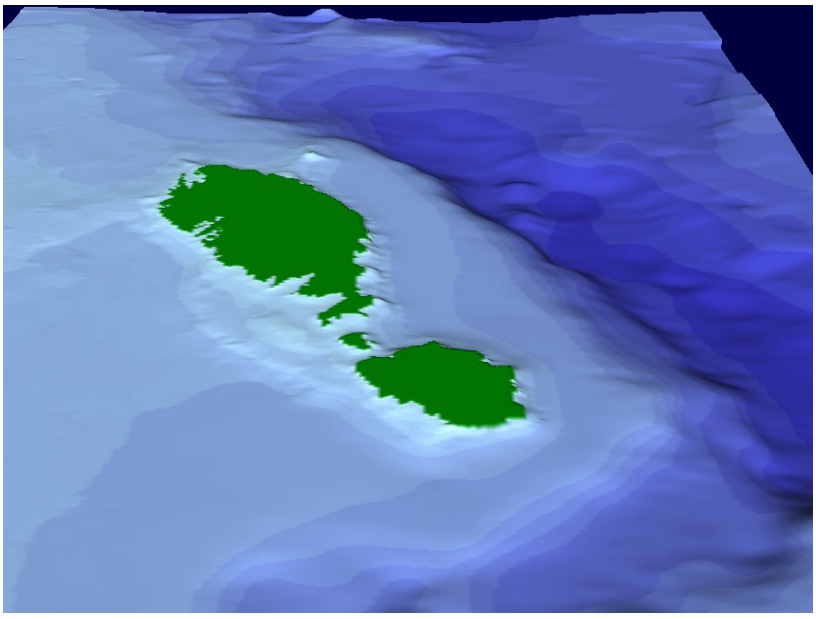
Malta Environment and Planning Authority

Detailed Investigations and Feasibility Studies on Land Reclamation at Two Indicated Search Areas, Malta

Technical Report 2

Volume 1: Main Text

April 2008



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MEPA
MALTA ENVIRONMENT & PLANNING AUTHORITY

Revision Schedule

Technical Report 2 - Volume 1: Main Text
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Table of Contents

PART A: EXECUTIVE SUMMARY AND INTRODUCTION

1 Executive Summary

Overview

1.1 The Malta Environment and Planning Authority (MEPA) has appointed Scott Wilson Ltd to carry out a feasibility study to determine whether reclamation of land from the sea is a realistic option for Malta. The Study is focused upon two specific search areas situated in Maltese waters and examines the issues related to the use of inert construction and demolition materials for reclamation, taking into account relevant technical, legal, environmental and economic factors.

1.2 The Study team is led by Scott Wilson, in association with Adi Associates Environmental Consultants Ltd.

1.3 A Land Reclamation Project Identification Report was commissioned by MEPA in 2004. The Project Identification Report presented a preliminary evaluation of the issues associated with reclamation including an overview of the coastal zone in Malta and the relevant legislation and policies. It also presents a preliminary evaluation of the potential for reclamation in six separate areas situated around the coast of Malta.

1.4 The Project Identification Report highlighted the need for further site investigations and pre-feasibility studies in order to establish an informed basis for the decision on whether or not to proceed with a land reclamation project. MEPA carried out a short-listing exercise to reduce the six areas identified within the Project Identification Report to two areas. The decision to proceed with further investigation of Area 1 and Area 3 was approved by the Malta Government.

1.5 The specific objectives of the Terms of Reference are two-fold:

(i) To perform a detailed investigation of the marine environment in Area 1 and Area 3 as identified in the Project Identification Report; and

(ii) In the light of the findings of (i) above, to carry out a feasibility study on the land reclamation options in the two areas.

Activities undertaken

1.6 The following main activities were undertaken as part of the Study:

- A marine baseline survey including extensive sea bed habitat surveys using divers and remotely operated vehicles, together with field investigations of currents;
- A baseline desk study assessment of environmental issues, including ecology, ornithology, fisheries, archaeology, social aspects and planning policy;
- Desk study assessment of the inert waste stream: its origins, causes, size, future projection scenarios, and alternative uses;

- Assessment of options to create land reclamation: where, how, what shape, constraints on land reclamation;
- Numerical modelling of coastal processes such as waves, current and sediment transport in relation to possible reclamations
- Desk study assessment of environmental impacts at scoping level;
- Assessment of economics: costs of reclamation, benefits arising, overall economic position including calculation of net present value and internal rate of return;
- Assessment of legal issues, policies and plans; and
- Engagement with stakeholders to obtain data

1.7 The marine baseline survey and other environmental baseline data is presented in Technical Report 1.

Conclusions

Inert Waste Stream

1.8 Mean annual production of inert waste is between 2.1 and 3.3 million tonnes, largely comprised of unwanted excavation arisings of soft limestone known as Globigerina. Approximately 0.9 million tonnes is recycled, leaving a net annual production of unwanted inert waste of 1.2 to 2.4 million tonnes.

1.9 The bulk of this material is deposited in licensed quarries under a government sponsored scheme whereby quarry owners receive a payment per tonne of material deposited, but a substantial part is deposited in unlicensed quarries. A smaller element, about 0.2 million tonnes, is dumped at sea in licensed areas.

1.10 The information on the characteristics and quantities of the stream is limited due to lack of officially collected data at source or disposal. All quantities are estimated and therefore have to be treated with caution. There is little reliable information on whether the annual production is increasing with the general expansion of the economy.

1.11 There are some prospects of increased recycling of inert waste and of reduced production due to more efficient excavation methods, such as cutting out blocks rather than breaking up the material, however this is more costly and at present the adoption of this practice is left to market forces. Therefore it would not be prudent to rely on these developments significantly reducing the waste stream.

1.12 MEPA recently updated its study on the amount of disused quarry space in Malta.[1] MEPA concluded that there is a) 445,401 m^3 of void space on which action should be taken for acquisition with a view to infilling as soon as possible, b) 8,345,800m^3 of void space where some uncompacted infilling has already occurred and on which action should be taken to investigate possible acquisition, and c) 26,957,838 m^3 of void space that offers good

[1] Update on Disused Quarry Space in Malta, MEPA, May 2007

potential and on which action should be taken to investigate possible acquisition. Overall, the report identifies 35,749,048 m^3 of void space which, at current rates of infilling, could last for 12 years. Changes in payment per tonne deposited potentially affects the capacity which would be made available.

1.13 From the above it is clear that inert waste is a significant issue for Malta. Large volumes are being produced, but there is no long-term plan in place to accommodate this material. However, the time horizon within which action to provide additional capacity is essential is not clear. Approaches to reducing the production of the material, such as increasing taxation or encouraging alternative excavation methods, might be at least partially effective.

Technical Feasibility

1.14 Land reclamation using the inert waste material is in principle technically feasible providing it is bunded and contained. Numerical modelling of currents and sediment transport shows that uncontained deposition would lead to rapid erosion and dispersion of fine materials across large areas, which would be environmentally unacceptable.

1.15 Land reclamation has to be close to the coast in shallow water to optimise land created per tonne of waste and to reduce cost. Area 1 is preferable because it has larger areas of shallow water. Area 3 is technically feasible but more costly and results in a narrower, less usable land reclamation. Creation of islands is effectively not feasible as they would need to be in deep water, pushing up costs and requiring innovation in construction.

1.16 Technical difficulties of bund construction effectively restrict the feasible area for reclamation to areas of the sea bed shallow than 20m deep – i.e. areas within the -20m contour. Beyond this there is very little experience of land reclamation and construction of breakwaters and costs and risks increase rapidly.

1.17 There is no apparent case for construction of submerged land, expect perhaps in the form of reefs to aid fishing. However these would not absorb a significant part of the waste stream or produce an obvious commercial return.

1.18 Apart from perhaps aesthetics, and maintenance of existing landscapes and views, there is no obvious reason for island creation as opposed to land extension, and the physical nature of the seabed in Areas 1 and 3 limits possible islands to Area 1 only. Creation of an island would involve greater costs, and would lead to construction in deeper water incurring high risks. Reclamation would most logically be constructed by end tipping of trucks to create a contiguous land extension rather than an island.

1.19 A total of 11 indicative land reclamation shapes were identified, giving a range of waste acceptance capacities from 1.8 to 20 million m^3, assuming the objective is to develop land at minimal cost. This would require a fill level of about 5 metres above sea level. If these shapes were not developed, but were instead filled to a level of 25 metres above datum, then the capacities would range from 4.7 million m^3 to 46 million m^3. The shapes have surface areas ranging from 17 to 129 ha.

1.20 The 11 shapes are not a definitive list of possible reclamation options, as there are many variations that could be applied, but do provide an 'envelope' of possible shapes that together provide an overall approach to land reclamation – in effect the optimum shapes can be created from one or more of these shapes in combination.

Costs

1.21 Costs were established for each reclamation shape, using a combination of Maltese experience and experience from marine projects worldwide. The present value cost of creating the reclamations was assessed as ranging from €42 million to €546 million using a public sector discount rate of 5%.

1.22 Costs vary according to the volume of fill that would need to be placed, the length and cross-section of bunding structure required to contain the fill, and the cost of preliminary studies and investigations. Where reclamation shapes require construction of bunds in relatively deeper water, or a large length of bund (for example in the case of an island) then the costs increase significantly, particularly in the early stages of the project.

Infrastructure Requirements

1.23 Infrastructure in this context means the roads, drainage, utilities etc. required to make the reclamation developable. It does not include provision of services to individual plots, but provision to the reclamation and provision of a 'spine' from which services can later be provided to individual plots. Infrastructure requirements were assessed in a largely generic way for both Areas 1 and 3. Detailed requirements could not be evaluated at his stage of project development, because the size and nature of the development, particularly its after-use, has not been determined. Nonetheless an initial appraisal has been made. In principle, infrastructure issues and costs will not be a determining factor in the feasibility of the project. These are significantly outweighed by costs of reclamation construction.

Implementation

1.24 Implementation of a significant land reclamation project would take of the order of 5 years to study and design, and to take through the planning and EIA process.

1.25 A project of this type raise a large number of questions about how it would be funded and managed, what contract forms would be used, how ownership would be dealt with and so on. Because of its unique nature, there is no well-defined optimum model to follow. These issues would need to be studied in more detail if the project was to be taken forward.

Economic Assessment

1.26 A number of possible land reclamation shapes were assessed economically. The assessment has included looking at:

- The cost per m^3 of fill material placed in a reclamation as a comparator to costs for fill placed in quarries or dumped at sea;

- How costs per m^3 of fill material placed vary with the level to which fill is placed;
- What return a private sector project to create land from land reclamation would generate, assuming the land was suitable for development;
- What return the public sector would get from a project to create the land and develop it; and
- The benefits to the economy of a project to create the land and then develop it.

1.27 Because of the differing timescales for the various land reclamation shapes, this was undertaken using discounted cash flow methods with suitable discount rates. It was found that:

1.28 The cost of placement ranges from €15 to €40, compared to around €3 for placement in quarries and €4 for dumping at sea, so land reclamation is a more costly approach. If the filling level is raised to +25 metres, this reduces costs to €9 to €28. Because more fill can be accommodated for a given area. This is still more than the cost for placement in quarries.

1.29 A suitable rate of return for a private sector project to be viable (around 15%) would only be achieved by some of the land reclamation shapes, generally those with shorter timescales for completion and located in shallower water depths. Most of these are within Area 1, some within Area 3. Islands would not be viable.

1.30 In terms of impact on the economy of Malta, a land reclamation project would generate present value benefits of between €616 million and €3180 million and produce a rate of return of 10-40%. The highest returns would be achieved by reclamations in shallower waters, typically those in Area 1. It would therefore meet government investment criteria. However, this conclusion is dependent on the land being subsequent developed along lines similar to the proposals for SmartCity. Smart City has been evaluated as producing net annual benefits to the economy of up to €800 per square metre. There remains a question mark over whether there is sufficient demand for this scale of development. This would need to be the subject of a more detailed assessment, possibly with direct dialogue with potential developers

Environment and Legal Issues

1.31 A baseline environmental assessment has been made of Areas 1 and 3. This has included a combination of desk studies, numerical modelling and field investigations. The programme of work to support the environmental assessment has been substantial, with the following included:

- Sea bed surveys of seagrass bed extent and quality, using divers and remotely operated vehicles down to depths of 40 metres;
- Field measurement of currents;
- Desk studies of fishery issues, birds, archaeology;

- Numerical modelling of currents
- Assessment of wave climate and numerical modelling of wave action along the coast

1.32 An initial assessment of environmental issues related to land reclamation in Areas 1 and 3 has been made. This work has included:

- dispersion of sediments from disposal sites;
- footprint of land reclamation in relation to protected habitats;

1.33 The key environmental baseline data from Areas 1 and 3 includes the following:

Area 1

- The majority of the proposed reclaimed areas in shapes 1b, 1d, and 1e, and about 50% of the proposed reclaimed areas in shapes 1a and 1c, coincide with *Posidonia oceanica* communities. All reclamation shapes in Area 1 also coincide with infralittoral algal communities and *Cymodocea nodosa* communities. Additionally, all reclamation shapes in Area 1, apart from reclamation shape 1b, are within 500m of an ecologically important designated site. Reclamation shape 1c also includes an ecologically important designated site within its footprint.
- Area 1 has a high archaeological potential. Archaeological objects recovered from Area 1 include Roman shards, two Roman anchors, a Roman corn grinder, a ballast heap, and amphora necks from the late Roman or early Byzantine periods.
- Locally-breeding species of avifauna recorded in Area 1 include the Short-toed Lark, Zitting Cisticola, Sardinian Warbler and Spanish Sparrow. Quail and Short-eared Owls have also been recorded flying in the area. Movements of Cory's Shearwater, Yelkouan Shearwater, Great Cormorants and Gulls have been recorded within and offshore Area 1. A feeding area for protected bird species is only found in the footprint of reclamation shape 1c. Feeding areas for other bird species are found within the footprint of reclamation shape 1c. In strong winds, flyways within 1 km of all reclamation shapes are used by protected and other bird species.
- The coastal area abutting Area 1 consists of karstland supporting marine garrigue and is thus of high ecological, scientific, and scenic importance.

Area 3

- The majority of the proposed reclamation areas in shapes 3a, 3b, 3c, 3d, 3e, and 3f coincide with infralittoral algal communities. Reclamation shapes 3a, 3b, 3c, 3f and 3g also coincide with *Posidonia oceanica* communities.
- Locally-breeding species of avifauna recorded in Area 3 include the Short-toed Lark, Zitting Cisticola, Sardinian Warbler, Spanish Sparrow, Common Swift and Tree Sparrow. Quail and Short-eared Owls have also been recorded flying in the

area. Movements of Cory's Shearwater, Yelkouan Shearwater, Storm Petrels, Single Gannets, Great Cormorants and Gulls have been recorded within and offshore Area 3. Bird species congregate to feed over the sewage outfall in Area 3. In strong winds there are flyways used by protected and other bird species within 1 km of all reclamation shapes.

- The archaeological potential of Area 3 is high. The main archaeological 'objects' discovered on the seabed of Area 3 or within its vicinity consists of a series of modern wrecks datable to the Second World War: Schnellboot S-31, HMS St Angelo, HMS Eddy, The Hellespont and HMS Southwold.
- The coastal area and valleys within the Ricasoli / Kalkara area are scheduled or listed as Areas of Ecological / Geological Importance and Sites of Scientific Importance in the respective Local Plans. Part of the Ricasoli peninsula coincides with a scheduled Area of High Landscape Value.

1.34 *Posidonia oceanica* beds are listed as a 'priority habitat type' in Schedule I of the Flora, Fauna and Natural Habitats Protection Regulations, 2006[2]. *Cymodocea nodosa* beds are listed in Schedule III of the Flora, Fauna and Natural Habitats Protection Regulations, 2006. Large shallow inlets and bays, and reefs in Area 1 are also listed under these Regulations.

1.35 The relevant environmental legislation and legal implications include the following:

- It is important to obtain a confirmation from the Competent Authority that the material to be used for land reclamation is not considered to be waste and therefore the provisions of Legal Notice 337 of 2001 do not apply, and to change Legal Notice 128 of 1997 to allow for placement of matter on the seabed as in land reclamation operations.
- The Structure Plan does not give guidance on land reclamation as such. However, projects that involve extension of beaches would require detailed studies. There are other sectoral policies within the Structure Plan that are applicable to Areas 1 and 3, although they do not concern land reclamation *per se*. These policies regard:
    - Settlement Pattern (SET and HOU): A key target of the 1992 Structure Plan was to contain urban sprawl within the development boundary defined by the 1988 Temporary Provisions Schemes and the Primary Development Areas. ;
    - Built Environment (BEN);
    - Tourism & Recreation (TOU, REC);
    - Transport (TRA);
    - Conservation (RCO, MCO, CZM); and
    - Public Utilities.
- The Coastal Strategy Topic Paper directs development in accordance with the

[2] LN 311 of 2006; this transposes the EU Habitats Directive into local legislation.

objectives of protecting coastal and marine habitats and biodiversity, protecting cultural heritage, protecting coastal uses that necessitate a coastal location, promoting and protecting public access and use and minimising existing and potential user conflicts. The application of the policies is likely to weigh heavily the feasibility of reclamation projects.

- The Waste Management Subject Plan is only relevant to the land reclamation insofar as the material that would be used for the reclamation, predominantly Globigerina Limestone, is currently generally considered to be inert waste and not a resource.
- Central Malta Local Plan: Depending on their extent, land reclamation projects in Area 1 on the coastline immediately adjacent to Ghallis / Bahar ic-Caghaq are highly likely to be incompatible with the requirements of Policy NA04.
- Grand Harbour Local Plan: Two policy areas are relevant to the feasibility of land reclamation in Area 3: the protection of natural heritage, and the designation of a site for public works. Additionally, according to the Local Plan, much of Area 3 should be subject to a coastal zone management programme.
- South Malta Local Plan: Policies SMCO 3 and SMCO 7 (presumption against development that would affect Areas of Ecological Importance / Sites of Scientific Importance and Valleys), are relevant to the feasibility of land reclamation in Area 3.

1.36 It was concluded that the major environmental issue is the presence of protected seagrass habitats over much of the seabed within the -20m area. This habitat is protected under EU law, and only a development of national importance would justify construction in this area. It is concluded that land reclamation for the purpose of accommodating inert waste and creating land for development is not of sufficient national importance for the project to go ahead.

1.37 Therefore it was concluded that only the areas without seagrass beds should be considered further for land reclamation. This limits land reclamation to the northern part of Area 3.

Overall Conclusions

1.38 Assuming that a land reclamation project was to be progressed, then the preferred location for land reclamation is the northern part of Area 3. This is the only area which satisfies all technical constraints and which meets the most critical of environmental constraints. The initial economic analysis is also reasonably favourable, particularly in terms of a public sector project. In principle, land reclamation in this area is therefore a ***realistic*** option**.**

1.39 There are however, many environmental and legal issues that are not favourable. These include the occurrence of *Posidonia oceanica* and *Cymodocea nodosa* communities in the majority of the proposed reclamation shapes, the presence of locally-breeding species of avifauna and feeding areas for protected bird species the high archaeological potential of the seabed in both Areas 1 and 3, and the coastal areas abutting the proposed

reclamation areas which are scheduled or listed as Areas of Ecological / Geological Importance, Sites of Scientific Importance and / Area of High Landscape Value. Several sectoral policies in the Structure Plan are relevant to reclamation in Areas 1 and 3; particularly important is the key target of the plan to contain urban sprawl within the development boundary defined by the 1988 Temporary Provisions Schemes and the Primary Development Areas. The application of policies in the Coastal Strategy Topic Paper, in particular the promotion and protection of public access to the coast are likely to affect the feasibility of reclamation projects. The latter are also likely to be incompatible with the Local Plans policies that protect the natural and cultural heritage of the coastal zone.

1.40 Negative impacts of an urban type development are likely to be greater than that for a passive type development such as parkland or nature sanctuary,

1.41 The degree to which the project would be attractive to the private sector is considered limited at present. Although a project in Area 3 has the potential to achieve the required rate of return to make investment attractive, the combination of rather marginal returns with risks associated with lack of security of material supply, as described below, probably make the project unattractive to the private sector.

1.42 The level of government spending which would be required to take a project forward is for all but the smallest options considered, very large- in the order of hundreds of millions of euros. It would appear prudent to attempt to improve the understanding of the waste stream, and consider other measures to reduce the size of that stream, before embarking on such as high cost project.

1.43 There is also some uncertainty in the demand for afteruses to support land reclamation on the large scale that would be the case for any project.

1.44 There is uncertainty in terms of government approach to waste taxation and other factors which might in the future affect the need for and the materials for the project. There is a question over whether changes in taxation and waste polices might help drive the amount of material generation down and recycling up to reduce the demand for disposal capacity and increase the time horizon before new capacity is required.

1.45 The data on the waste stream, which provides a significant motive for land reclamation and the material required, is somewhat unreliable. Although there is clearly a stream of material which is surplus to requirements, it is not entirely clear what the volume of this stream is, nor how it will change in the future. The expansion of the Freeport at Marsaxlokk Bay could provide an alternative means of accommodating inert waste.

1.46 Therefore the land reclamation project should only go ahead if there is no other possible means of dealing with the material being generated, and all quarry space has been exhausted. If there is a period of many years before that situation arises, then it would be logical to concentrate on improving the effectiveness of existing policy and economic instruments to reduce inert waste generation rather than going directly to land reclamation. In tandem with this, further work is required to fill the identified data gaps to support a project go-ahead. This should take the form of high level studies, together with enhanced

collection of waste data over a period of 2 or more years to further substantiate the figures. A site-specific feasibility study, based on the northern part of Area 3, would follow if the high-level studies produced positive findings. Recommendations are set out below.

Recommendations

Overview

1.47 The project should be taken forward by a combination of site specific studies to develop a land reclamation option in more detail, and high-level studies looking at other aspects of the waste generation situation:

High-level Studies and Data Collection

1.48 These would include:

- Assessment of alternative procurement and investment approaches, resolution of private/public ownership issues, identification of responsible authority to take project forward. This task encompasses all the investigations and decisions required to arrive at a robust approach to who will take responsibility for the project in government, how the project will be funded, how it will be delivered and how the land created will be developed and who it will be owned by. There are obviously some parallels to draw from in Malta, such as the Freeport and the Smart City project. There are also models from international experience, such as the inert waste reclamation in Jersey, and the large reclamations in Dubai and, Bahrain. Each of these has a different approach.

- Review and resolution of issues related to ensuring material supply, in the context of waste management policies and mechanisms for waste reduction, the taxation regime, renewal of land filling contracts etc. In order for the project to be secure, the supply must be maintained which means the project must have some level of governmental 'protection' against adverse impacts which could arise from changes in legislation, licensing agreements or taxation policies.

- Measures to improve reliability of waste stream data, through monitoring, source and disposal correlation, questionnaires of industry implemented over a 2 or more year period to provide unequivocal waste stream data.

- Review of alternative space data from quarries.

- Consultation on alternative disposal options and recycling and introduction of new excavation techniques

1.49 Providing that the above studies produced a positive finding, then the project would advance to site-specific studies as set it below.

Site-specific Feasibility Study

1.50 A Site-specific feasibility study should focus on the northern part of Area 3 for reclamation and fully explore the issues associated with reclamation at these sites. A programme of work should include:

- Detailed evaluation of wave climate at sites to support an outline design of edge protection and a risk-based assessment of alternative construction approaches. Evaluation of wave climate is likely to include both desk-based methods and an element of site-specific field data collection;
- Preparation of a phasing plan identifying programme for each phase, to enable construction planning and to support the economic assessment;
- More detailed construction costings. In order to make costings as accurate as possible, both local and major international contractors would be consulted (without any commitment) to verify rates.
- Preparation of a conceptual master plan for the development, to support the assessment of economics for the development and the costing of infrastructure requirements;
- Detailed economic and financial assessment for the proposed sites, taking into account the more realistic phasing plan, nature of the sites , information on demand and land values at these locations and identifying whether the project is beneficial to the country and viable as an investment opportunity for others;
- Site-specific assessment and costing of infrastructure requirements, linked to a realistic and agreed master plan concept;
- Site-specific baseline environmental surveys and outline EIA
- Preparation of a risk register, with identification of risk percentages, outturn impacts (on programme and costs) and mitigation measures.
- Investigation of geotechnical properties of the seabed at the sites, to ascertain suitability for the proposed works and engineering parameters such as bearing capacities, likely consolidation rates, and need for removal of any soft sediment layers.
- Site survey, including both seabed levels and adjacent land topography. The marine survey would probably include measurement of currents and water levels and wave heights and directions;

1.51 The results from these studies would be a report setting out a site-specific assessment of the project, its costs, risks, economics, finances and environmental issues. The timescale for this phase would be about 12 months.

Detailed study, EIA and planning

1.52 This phase would take the project from feasibility to completion of designs and all planning requirements. It would include:

- Design of reclamation and edge protection, with full drawings and specifications. A client's preferred design would be produced, as a basis for costing, phasing and risk assessment. However, normally alternatives to this would be allowed providing that the alternatives meet the performance specifications.
- Design of infrastructure, with full drawings and specifications;
- Preparation of contract documents for a selected preferred procurement approach. This would involve a number of contracts, both for the construction phase and for the investment/ownership aspects, including responsibilities for maintenance, arrangements for land sales and post-construction ownership;
- An agreed master plan for the development;
- A full EIA or Environmental Statement, to support a planning application. The EIA/ES would include proposals to monitor and mitigate impacts associated with construction such as traffic, noise, control of materials deposited into the water column, protection of habitats etc. For a project of this size it would almost certainly need to be accompanied by illustration media such as virtual images, fly-throughs, artist's impressions etc. and by a stakeholder engagement and consultation summary.

1.53 Including the planning process, this phase might take a further 12 to 24 months. At the end of the phase the responsible authority would have an implementable scheme.

2 Introduction

2.1 The Malta Environment and Planning Authority (MEPA) has appointed Scott Wilson Ltd to carry out a feasibility study to determine whether reclamation of land from the sea is a realistic option for Malta. The Study is focused upon two specific search areas situated in Maltese waters and examines the issues related to the use of inert construction and demolition materials for reclamation, taking into account relevant technical, legal, environmental and economic factors.

2.2 The Study team is led by Scott Wilson, in association with Adi Associates Environmental Consultants Ltd. Additional specialist inputs were provided by the following technical experts:

- Economics: Dr Gordon Cordina and Ms. Stephanie Vella
- Legal aspects: Dr Simone Borg
- Civil engineering: Ing. Joseph Sciortino

Background

2.3 A Land Reclamation Study: Project Identification Report was commissioned by MEPA in 2004[3]. The Project Identification Report presents a preliminary evaluation of the issues associated with reclamation including an overview of the coastal zone in Malta and the relevant legislation and policies. It also presents a preliminary evaluation of the potential for reclamation in six separate areas situated around the coast of Malta.

2.4 The Project Identification Report highlighted the need for further site investigations and pre-feasibility studies in order to establish an informed basis for the decision on whether or not to proceed with a land reclamation project. MEPA carried out a short-listing exercise to reduce the six areas identified within the Project Identification Report to two areas. The decision to proceed with further investigation of Area 1 and Area 3 was approved by the Malta Government. To maintain consistency, the notation used to refer to Areas in the Project Identification Report has been adopted for this Study.

The Study

2.5 Terms of Reference for this Study are centred on studies of the marine environment in two targeted areas; the specific objectives are two-fold:

(i) To perform a detailed investigation of the marine environment in Area 1 and Area 3 as identified in the Project Identification Report; and

(ii) In the light of the findings of (i) above, to carry out a feasibility study on the land reclamation options in the two areas.

[3] Carl Bro (2005) Land Reclamation Study: Project Identification Report.

2.6 The general location of the Areas are shown in Figure 1-1. More detailed location plans of Areas 1 and 3 are presented in Figure 1-2 and Figure 1-3 respectively. The seaward boundaries of both Areas are delineated by the 50m depth contour.

2.7 The Terms of Reference divides the Study into two Components, as described below.

2.8 Component 1 comprises "A marine baseline survey, which enables an assessment of the present marine environmental conditions along with the carrying capacity of the marine environment. The marine survey should provide the basis for characterization of the marine environment with respect to environmental value in the context of designating protective zones under the EU habitat directive and identify the significant impacts on the environment of a large-scale marine structure in the area." The elements of the Study undertaken for Component 1 were presented in Technical Report 1.

2.9 The data set reported in Technical Report 1 has been prepared through a combination of primary and secondary data collection techniques, and for the first time allows an informed understanding of the receiving environment (both physicochemical and natural) in Area 1 and Area 3.

2.10 Component 2 comprises "A detailed Feasibility Study describing the land reclamation process in sufficient detail to allow the decision makers to take a final decision on whether to go for land reclamation or not, in Areas 1 and 3."

Scope of Technical Report 2

2.11 Technical Report 2 builds upon the extensive programme of baseline data collection undertaken as part of Component 1 (and reported in Technical Report 1) and presents the findings of the specialist studies undertaken for Component 2 of the Study.

2.12 A number of organisations and individuals were consulted as part of Component 2 of the Study; their input is gratefully acknowledged by the Study team. Meetings were held with the following individuals and organisations:

Organisation	Representative	Date of meeting/phonecall
States of Jersey (Transport and Technical Services Department)	Quentin Murfin	3 July 2007
WasteServ Malta Ltd.	Vincent Magri, Krista Rizzo	4 September 2007
Malta Freeport Terminals Ltd.	Joseph Bugeja	5 September 2007
Water Services Corporation	Marc Muscat, Joseph Curmi, Stephen Galea St John	17 September 2007
Polidano Group Ltd.	Boris Farrugia	8 October 2007
Malta Maritime Authority	Chris Farrugia, Dr Marc Bonnello	Various

Denfar Ltd.	Denis Farrugia	Various: September – November 2007
A. Camilleri Group	Anton Camilleri	Various
Resident Twinning Advisor MT05-IB-EN-01	Hans-Joerg Zerz	Various: August – November 2007
Asfaltar Ltd.	Perit Sandra Vassallo	Various

2.13 A site visit was arranged by WasteServ Malta Ltd. to a number of WasteServ's waste disposal facilities. The project team were guided round the sites by George Guillaumier, of WasteServ Malta Ltd.

2.14 A workshop was held on 6 September 2007 to inform stakeholders about the reclamation study and its aims. A presentation was given outlining progress followed by a discussion session, during which stakeholders were invited to provide feedback to improve the project team's understanding of the constraints on reclamation in Malta and the potential local benefits that may arise from a reclamation scheme. Information from the workshop is reproduced in Annex A of the Appendices and includes the presentation given at the workshop and notes taken during the question and answer session.

2.15 This report examines the technical, economic and environmental feasibility of land reclamation. In order to present a robust and transparent discussion and evaluation of the overall "feasibility", each of the three elements (technical, economic and environment) have been examined and presented independently in he first instance, and then a synopsis of the overall feasibility (or sustainability) brings these elements together at the end of the report. To reflect this, Technical Report 2 is presented in five parts:

Part A: ***Introduction and Executive Summary,*** including;

- *Chapter 1 - Executive Summary* - Synopsis of the Study and the two Technical Reports;
- *Chapter 2 – Introduction* - Setting out the introduction to Technical Report 2.

Part B: ***Technical Feasibility, including;***

- *Chapter 3 – Material Properties* - Description of the nature of the inert materials including their properties;
- *Chapter 4 - Waste Stream* – Characterisation of the waste material including an analysis of existing and future predicted volumes;
- *Chapter 5 – International Practice in Use of Waste Materials for Reclamation* – Review of other major reclamation schemes (incorporating C&D materials) from around the world;
- *Chapter 6 – Reclamation Placement Options* – Outline of the general approaches to placement of inert materials;
- *Chapter 7* – Coastal Process Modelling – Numerical modelling of currents and sediment transport;

- *Chapter 8 – Construction Principles for Land Reclamation* – Describes the design principles and major activities associated with engineering a marine reclamation;
- *Chapter 9 – Opportunities for Use of Land Reclamation* – Discusses potential opportunities for future land uses on any newly created reclaimed land;
- *Chapter 10 – Infrastructure Requirements* – Describes the basic infrastructure needed to support afteruse development on a reclamation;
- *Chapter 11 – Implementation* – Discusses the potential mechanism by which a reclamation scheme could be procured;

Part C: Economic Feasibility, including;

- *Chapter 12 – Cost Estimates* – Breakdown of costs for major elements of construction activities for the various placement options;
- *Chapter 13 – Financial and Economic Evaluation* – Benefit cost analysis of the potential reclamation schemes;

Part D: Environmental Feasibility, including;

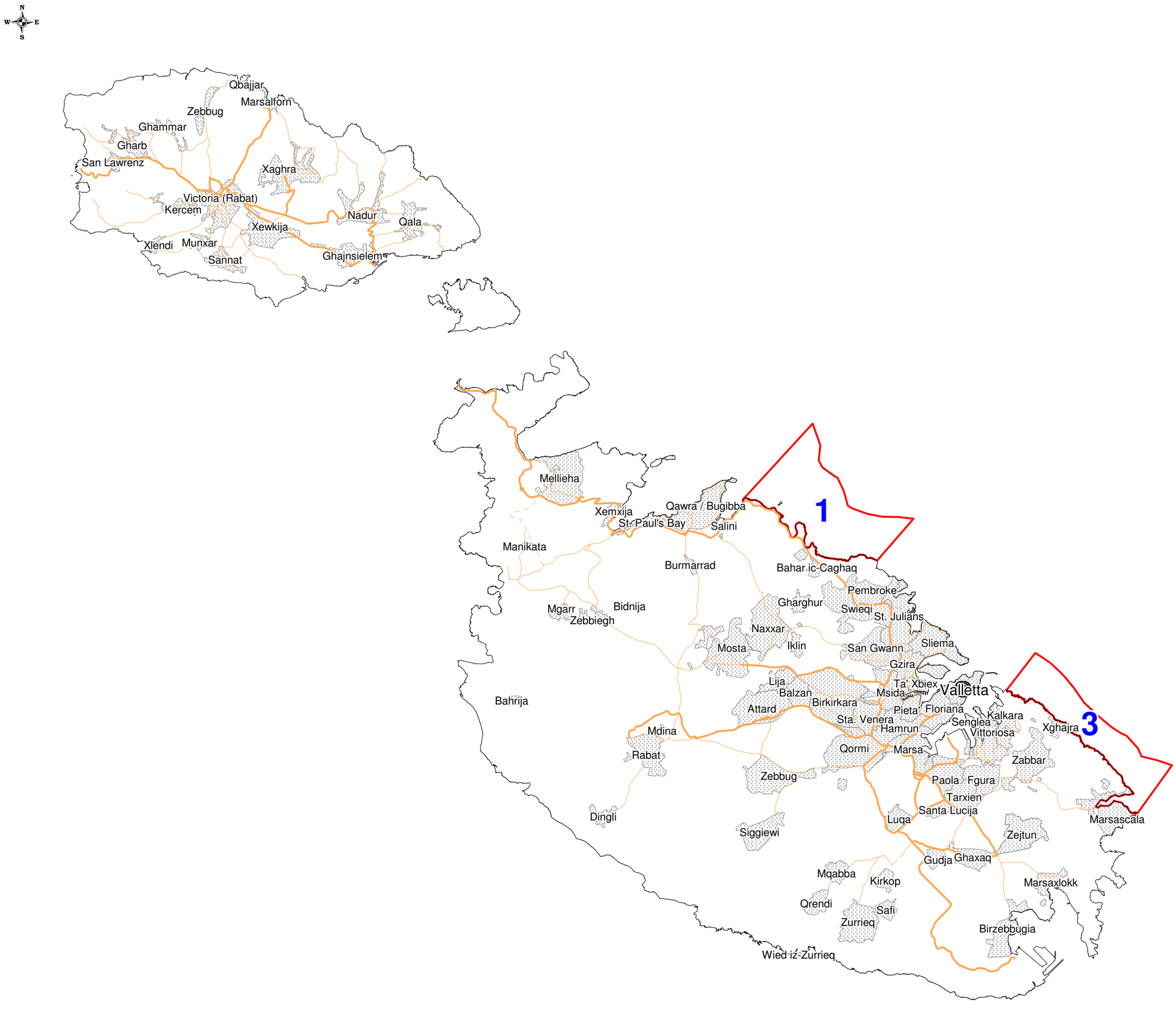
- *Chapter 14 – Environmental Policy & Legislation* – Discussion of the key environmental policies and legislation relevant to a potential reclamation scheme;
- *Chapter 15 – Environmental Appraisal* – Comparative evaluation of the environmental constraints in the Areas 1 and 3 and appraisal of potential impacts;

Part E: Integrated Assessment, Conclusions & Recommendations, including;

- *Chapter 16 – Integrated Assessment* – Overview of the interrelationship of technical, economic and environmental factors which determine the overall feasibility;
- *Chapter 17 – Conclusions* – Presents conclusions to Technical Report 2;
- *Chapter 18 – Recommendations* – Recommendations for the subsequent phases of the development;

2.16 Additional supporting information has been compiled as appendices to this Report in a separate bound volume including:

- Annex A: Stakeholder Workshop Information;
- Annex B: Marina Demand Analysis: and
- Annex C: Discussion of Relevant Legislation.



Notes

Search area boundary

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

LOCATION OF SEARCH AREAS

SCALE AT A3:

1: 125 000

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FIGURE NUMBER:

FIGURE 1-1

REVISION:

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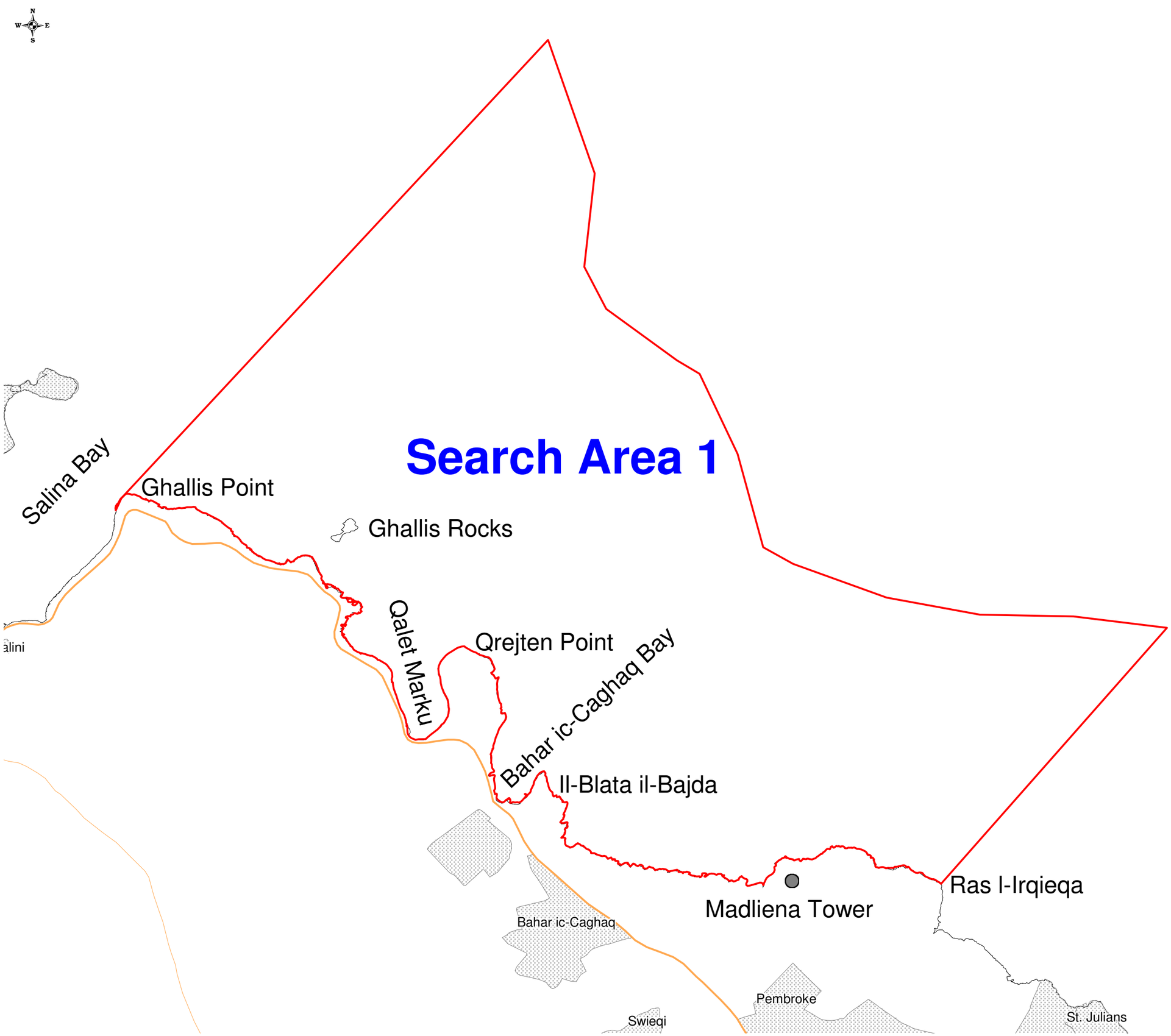

Notes

Search area boundary

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 1: DETAILED LOCATION PLAN

SCALE AT A3:

1: 20 000

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FIGURE NUMBER:

FIGURE 1-2

REVISION:

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Notes

Search area boundary

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: DETAILED LOCATION PLAN

SCALE AT A3:

1: 20 000

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FIGURE NUMBER:

FIGURE 1-3

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PART B: TECHNICAL FEASIBILITY

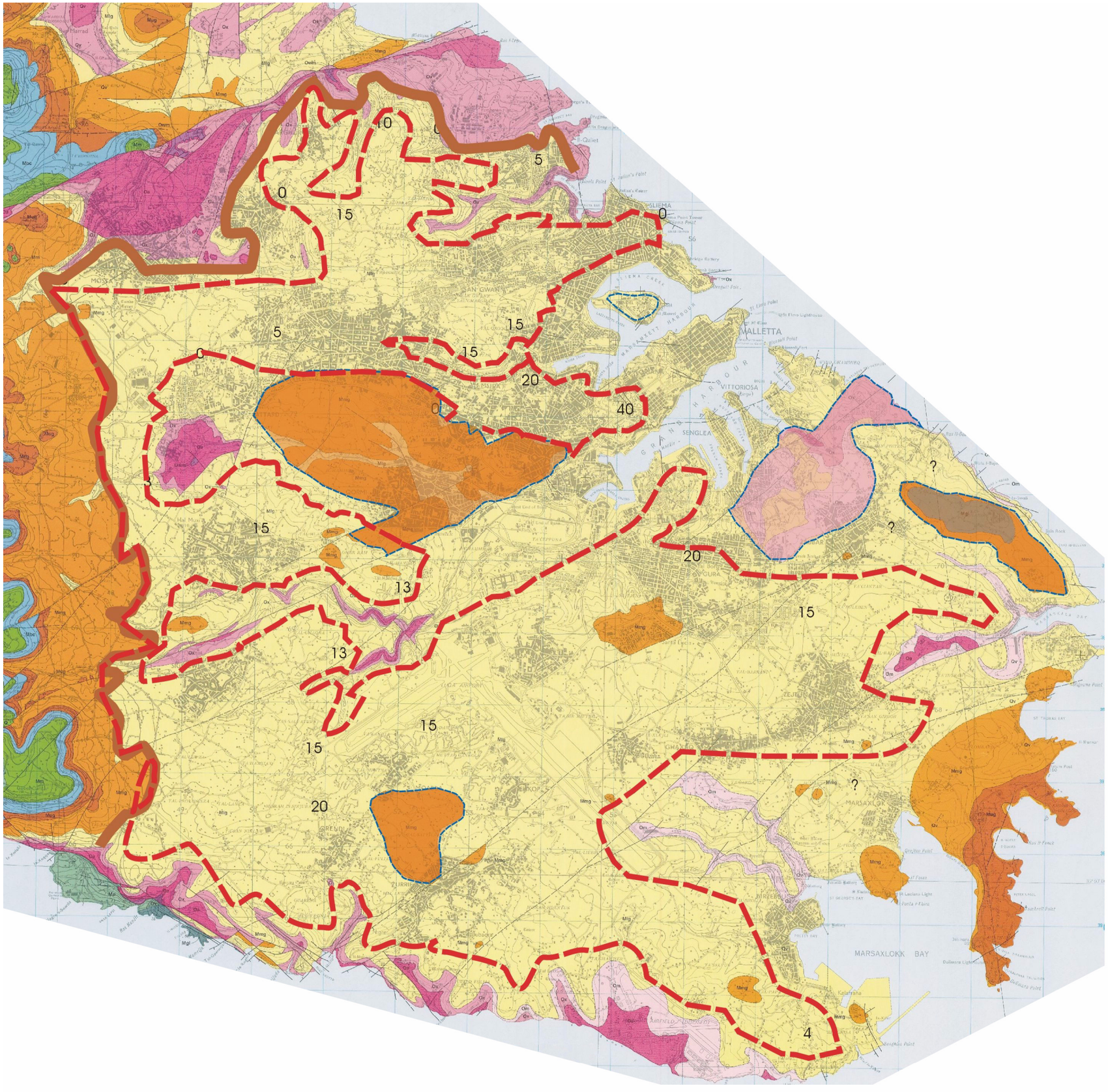
3 Material Properties

Material Type

3.1 Material excavated from construction sites and other projects in Malta is predominantly of two rock types: Coralline Limestone (hardstone) and Globigerina Limestone (softstone). Virtually all the Coralline Limestone is re-used and doesn't enter the waste streams. Coralline Limestone is not addressed further. The bulk of Globigerina Limestone is either treated as waste for disposal or is re-cycled for use as crushed softstone either in its raw state or as an input to lean mix concrete

3.2 The quality of the Globigerina Limestone varies according to the excavation location and the depth of the excavation. Much of the good building stone (known locally as *Franka*) lies in urban areas, giving rise to considerable harvesting potential if it could be harvested economically and without unduly delaying the construction project. Figure 3-1 shows the extent of good quality *Franka* stone. It covers most of Sliema, St Julians, San Gwann, Hamrun, Birkirkara, Attard, Luqa and Malta International Airport, Qrendi, Siggiewi, Zurrieq, Ghaxaq, Zejtun, Fgura, Bulebel Industrial Estate, and Corradino. In short, most of the urban area overlies good quality building stone.

3.3 The quality of softstone varies by depth. Figure 3-2 shows a typical profile of the Globigerina Limestone Member. (The nomenclature for the various layers varies across the Islands.)



Notes

Quality building rock extent

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

EXTENT OF BUILDING QUALITY GLOBIGERINA LIMESTONE

SCALE AT A3:

NTS

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FIGURE NUMBER:

FIGURE 3-1

REVISION:

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Bed No 1: *Tal-Martel*l (top weathered layer) – variable number of courses 4 to 5 courses on average.

Bed No 2: *Bajda bis-slieh*

Bed No 3: *Bajda sabiha*

Bed No 4: *Safra bit-tbajja tas-sadid*

Bed No 5: *Soll*

Bed No 6: *Bajda ta' taht is-Soll* or *Safra Cara*

Bed No 7: Transition zone

Bed No 8: *Soll ikhal* at the base

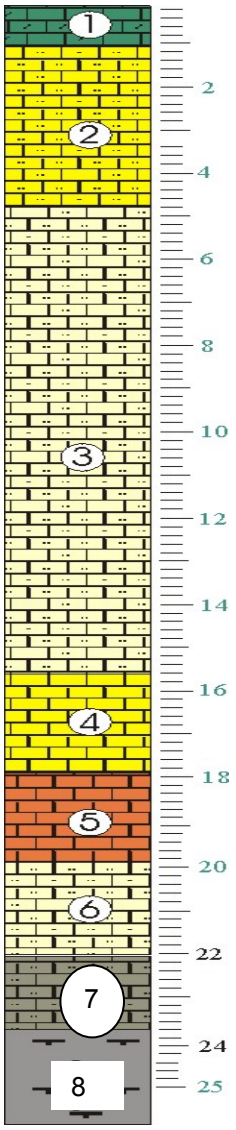


Figure 3-2: Typical lithologic column showing the Globigerina Limestone stratigraphy[4]

3.4 Only beds 2, 3, and 4 are regarded as suitable for building. The clay content of the *soll* beds is usually too high for it to be used above ground, but it is sometimes used below ground for foundation works. The typical characteristics of each bed are described in Table 3-1.

[4] Source: Dr Saviour Scerri : information based on the numerous site investigations that he has undertaken and based on his knowledge of the distribution of the resource.

Table 3-1: Typical characteristics of Globigerina Limestone[5]

Bed No	Colour		Rd ssd	WA %	Q N mm^{-2}	Mr N mm^{-2}
	Hue	Value/Chr				
1	Weathered Layer					
2	2.5Y	8/4	2.06	15.72	12.62	4.32
3	2.5Y	7/4	2.08	16.47	11.23	3.37
3	2.5Y	8/3	2.06	16.14	10.41	3.43
4	2.5Y	8/3	2.05	14.55	9.92	3.44
5	2.5Y	8/3	2.15	11.55	9.11	3.13
6	2.5Y	8/2	2.16	13.06	9.62	2.96
7	Not tested - poor geotechnical characteristics					
8	2.5Y	8/3	2.06	17.77	6.82	2.36

Where Rd: Relative density; ssd: Saturated Surface Dry; WA: water absorption; Q: Uniaxial compressive strength; Mr: tensile strength

3.5 The average compressive strength suitable for building stone is 9.3N/mm^2. Material below this strength is only suitable for screed / non-structural concrete.

Properties

Engineering Properties

3.6 Typical geotechnical characteristics of Globigerina limestone include a compressive strength of between 10 and 15N/mm^2 for competent bands of Globigerina, a saturated density of around 22kN/m^3 with a water absorption of around 10%.

Granulometric Properties

3.7 Globigerina is an extremely friable material. The granulometric properties of globigerina quarry and general excavation waste are highly dependent on both the method of extraction and the method of handling. In Malta, typical extraction methods include blasting, breaking, ripping, band saw and trenching (chain saw). Handling is by both tracked and rubber-tyred plant.

3.8 In limestone block quarries, the waste from the chain saws is practically all dust in the PM_{10} to 125μm range.

3.9 In hard coralline limestone quarries where the globigerina is overburden, the blasting technique greatly influences the size of the resulting material which is sometimes sold as backfill. Any tracked machinery operating at the quarry face generally grinds the material further. Analysis of one typical fill indicates approximately 75% of the material to be less then 75μm and may therefore be regarded as dust: with 15% in the range 30μm to 75μm; 18% in the range 10μm to30 μm; and 42% less than 10μm.

[5] Source: Dr Saviour Scerri

3.10 In general excavation projects for underground car parks, the two most favoured excavation methods are breaking and ripping. Whereas breaking with a hydraulic excavator produces fewer fines, the lower rate of excavation and the noise nuisance associated with this method have made ripping more commonplace. Ripping produces considerably more fines and the heavy tracked machinery required further grinds the ripped material into finer particles. Although no known direct tests have been performed on this type of material, it may be safely assumed that at least 30% of the material is in the dust range.

3.11 Practically all trenching work in Malta is carried out by mechanical trenchers. This material is sometimes re-utilised as backfill in the trench itself. The bulk of the material is in the dust range and no known tests have been carried out on this type of material.

3.12 Hence excavation waste supplied as backfill is likely to consist of around 30-40% material in the dust range. Unless the supply is strictly controlled at source, the delivered material may also include normal clay and blue clay clumps. The high percentage of fines renders the material only suitable for placing by tipping. Dumping by hopper barge will give rise to separation in the water column and uneven bedding of the fill.

Behaviour as Fill Material

3.13 The bulk density of submerged, normally compacted Globigerina backfill does not normally exceed 11 kN/m^3 (equivalent to a bulk density in the dry of 21kN/m^3)[6]. The high quantity of fines within the fill may hinder compaction and is likely to lead to settlement with time.

3.14 An area of land reclaimed using Globigerina Limestone fill material may require tanking against salt intrusion since the high fines content of the backfill material will tend to draw seawater up into the reclamation by capillary action which may present problems for structure foundations and vegetation.

[6] Higher densities of the order of 16kN/m^3 (submerged density) were achieved at Malta Freeport Phase 2 through the use of vibro-compaction.

4 Waste Stream

Introduction

4.1 The analysis of waste management issues underpins much of the technical studies on the technical, economic and environmental feasibility of a potential reclamation scheme. This chapter addresses three key areas, namely:

- An assessment of the types and quantities of inert waste generated historically;
- Consideration of alternative measures for the prevention of waste generation and recycling; and
- An analysis of the relationship between the quantity, suitability and rate at which waste materials will be generated, with respect to the requirements of the project.

Definition of Inert Waste

4.2 Inert waste is defined by Council Directive 1999/31/EC of 26 April 1999 on landfill of waste as waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn, otherwise physically or chemically react, biodegrade, or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.

4.3 Council Decision 2003/33/EC establishes criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC. Prior to disposal, inert waste must be verified as such according to the Waste Acceptance Criteria (WAC) established by Council Decision 2003/33/EC unless the type of waste is listed in Section 2.1.1. If there is suspicion of contamination, WAC and leachability testing must be carried out.

Inert Waste Policy

4.4 A summary is presented below of current national inert waste management policy; a full review is provided in Chapter 14.

4.5 The Waste Management Subject Plan, Space for Waste (2001) reports that in 1997, 750,000 tonnes of construction and demolition waste were deposited at Maghtab landfill site. It estimated that by 2000, construction and demolition waste arisings would increase to approximately 1.2 million tonnes. As also reported in the Minerals Subject Plan (2003), the Waste Management Subject Plan describes projections of inert waste arisings for the period to 2010 based on the assumption that a correlation exists between levels of inert

waste generated and economic activity. The Waste Management Subject Plan uses a baseline total of 1 million tonnes and an assumed rate of economic growth of between 3 per cent and 4.25 per cent, to project that 14 million tonnes of inert waste may be generated over the Plan period (2000 – 2010), an average of 1.4 million tonnes per annum.

4.6 The Solid Waste Management Strategy seeks to reduce the quantity of construction and demolition waste arisings by 20% by 2005, to recover 60% of rock and stone waste and to recover 50% of mixed inert waste. This target was not realised.

4.7 The Minerals Subject Plan indicates that MEPA would permit the location of recycling facilities and the storage of inert waste within operational quarries. The Waste Management Plan indicated that MEPA would support initiatives and determine proposals for new waste management facilities in "accordance with the principles of sustainable development and the following waste management hierarchy: (i) Reduction, (ii) Re-use and recycling, (iii) Recovery, and (iv) Final disposal. Policies SWM09 and SWM10 specifically address inert waste arisings, providing a clear mandate to reduce and re-cycle:

> ***Policy SWM09:*** *Applications for new waste management facilities should, where appropriate, include proposals for recycling of natural spoil and construction wastes for reuse as secondary aggregate or as material for landscaping or restoration.*
>
> ***Policy SWM10****: The Planning Authority will support proposals for temporary facilities on demolition and construction sites for the recovery, separation and where appropriate processing of waste materials generated by the on-site demolition or construction works provided that: (i) no waste materials are to be imported to the facilities at the site from elsewhere unless prior written authorisation is obtained from the Planning Authority and the Environment Protection Department; (ii) the proposal will not give rise to unacceptable impact on local communities or the environment; and (iii) the facilities are removed on completion of the demolition or construction project.*

4.8 In view of the above, and noting current practices and waste arisings, it would appear that although there is considerable Government support for the idea of implementing the waste hierarchy, in practice the construction industry's response is entirely market driven. For example, in the past up to one third of the excavated Globigerina Limestone was re-used as *Torba*[7] and road sub-base, but today the amount used has decreased substantially because as a result of more stringent specifications (from ADT) the material is no longer suitable. The introduction of new technology by the private sector could reverse this trend, but as in the past, it would be in response to market forces, not Government policy. There is clearly scope for Government to implement in practice the waste hierarchy.

Type and Quantity of Inert Waste Generated

4.9 Inert waste is generated as a result of construction activities, quarrying and demolition

[7] *Torba* is the Maltese term for the material laid over floors and roofs prior to tiling. It comprises crushed Globigerina Limestone ranging in size from sand to 10mm spalls.

activities. Inert waste arisings are predominantly geological excavation material; waste from the demolition sector is usually minimal[8] as a proportion of the total and is not discussed further. Geological excavation material principally arises from:

- Construction of roads and buildings (including excavation of basements);
- Removal of quarry overburden and rock wastage during quarrying;
- Excavation of utility tunnels and trenches; and
- Marine dredging.

4.10 For the most part, data on waste arisings at source are not available[9]. Sources of inert waste are typically numerous, short-lived and project related. Estimates within this chapter of the quantity of inert waste generated are based on data from the waste destination, rather than its source; available historic measurements of inert waste deposited at various disposal sites have been used to develop an understanding of the overall quantity of waste generated.

4.11 However, caution is necessary since the amount of waste being disposed of does not equate to the amount of waste generated because of illegal fly-tipping and the use of inert waste in landscaping schemes. It should also be noted that the analysis within this chapter is based on limited data since monitoring of the full range of waste disposal sites is not currently undertaken. When analysing the waste stream, it is necessary to bear in mind the inherent data gaps.

Historic Waste Disposal Situation

4.12 Prior to Malta's accession to the European Union (EU) in 2004, the majority of inert waste was deposited at the Maghtab landfill site. This was the primary disposal facility from the mid 1970s until Government closed Maghtab to inert waste disposal in May 2004. Inert waste disposal at the Maghtab site averaged 1 million tonnes per year over the period 1998 to 2002, as shown in Table 4-1.

[8] The exception being the demolition of the Ricasoli Industrial Estate, where the inert material has been dumped at sea.
[9] The exception to this is inert waste which is deposited at the official offshore despoliation grounds and a small number of large projects that have been subject to Environmental Impact Assessments or waste management permitting.

Table 4-1: Inert waste deposited at Maghtab Landfill site over the period 1998 – 2002[10]

	Quantity of inert waste (tonnes)					
Month	**1998**	**1999**	**2000**	**2001**	**2002**	**Average over period 1998 - 2002**
January	40,151	96,944	78,647	63,072	87,288	73,220
February	40,948	64,718	89,366	68,159	85,817	69,802
March	49,101	60,006	117,177	81,972	76,947	77,041
April	38,288	71,198	115,347	72,109	94,394	78,267
May	59,695	74,359	109,821	104,211	131,947	96,007
June	66,385	83,304	109,571	108,071	106,447	94,756
July	83,587	90,310	116,260	79,432	127,171	99,352
August	58,141	76,599	101,428	77,512	103,014	83,339
September	67,880	89,570	102,077	70,565	130,308	92,080
October	72,227	89,655	92,714	87,849	151,056	98,700
November	60,820	87,613	113,067	68,943	118,580	89,805
December	54,830	55,873	43,012	49,839	71,687	55,048
Annual Total	**692,053**	**940,150**	**1,188,489**	**931,734**	**1,284,655**	**1,007,416**

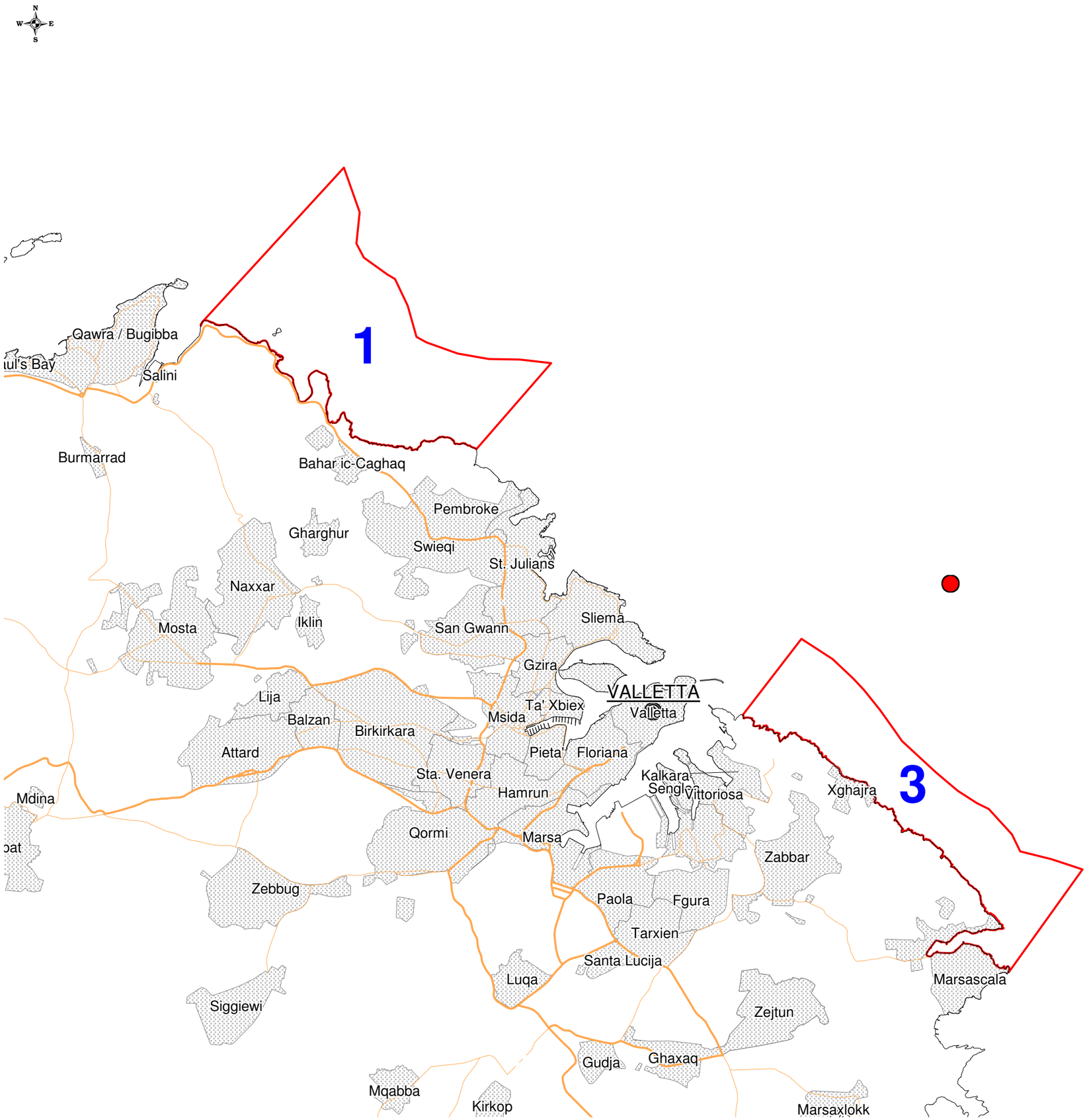
4.13 Commencing May 2003, inert waste arisings were also deposited in disused quarry voids under a WasteServ Malta Ltd contract, known as Package 1[11]. This contract initially succeeded in attracting the majority of inert waste arisings, but because of the fees involved the construction industry and other quarry void owners recognised business opportunities and other quarries outside Package 1 soon began to receive waste.

4.14 In addition to the land-based options, disposal of inert waste at sea in officially designated despoliation grounds off the east coast of Malta (see Figure 4-1) was the disposal method of choice for major projects for many years[12]. This is discussed in further detail below.

[10] Source: WasteServ Malta Ltd. Excludes street debris and tarmac fine dust

[11] Contract for the Provision of Services to Manage C&D Waste (Package 1): the WasteServ Malta Ltd contract for the reception and placing of inert waste in disused quarry voids is referred to as Package 1. It commenced on the closure of the Maghtab tip in July 2004 for a period of 5 years. The fees for tipping are structured as follows: From 01.11.2004: €2.53 (Lm1.09) per tonne, from 01.01.2005: €3.26 (Lm1.40) per tonne, from 01.01.2007: €3.44 (Lm1.48) per tonne.

[12] Malta's official offshore dumping site (established by Legal Notice 128 of 1997) is located at coordinates 35°55.1'N, 14°34.0'E.



Notes

Search area boundary

14° 34.0' E 35° 55.1' N

Projection: European Datum (1950)

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

LOCATION OF MARINE SPOIL GROUND

SCALE AT A3:

1: 65 000

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FIGURE NUMBER:

FIGURE 4-1

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Current Disposal of Inert Waste

4.15 Inert waste is currently disposed of in a number of ways, principally:

- Rehabilitation of disused quarry voids as part of Package 1;
- Rehabilitation of disused quarry voids that are not part of Package 1 but are permitted by MEPA to receive inert waste;
- Dumping at the officially designated despoliation grounds off the east coast of Malta;
- Coastal reclamation;
- Temporary stockpiling in operational quarries;
- Conversion of garrigue to agricultural land; and
- Recycling.

4.16 Each of these disposal options is considered in further detail below, and data presented (where available) of historic disposal rates.

Rehabilitation of disused quarry voids as part of Package 1 Contract

4.17 WasteServ Malta Ltd's Package 1 contract to place inert excavation material in disused quarry voids has been in operation since May 2003 and is ongoing. The quantity of inert waste deposited under the Package 1 contract is monitored as part of the contract, and waste quantities deposited under Package 1 are shown in Table 4-2. Inert waste disposal under the Package 1 contract averaged 1.37 million tonnes per year over the period 2003 to 2006.

Table 4-2: Inert waste deposited in disused quarry voids under the Package 1 contract over the period 2003 – 2006[13]

	Quantity of inert waste (tonnes)				
Month	**2003**	**2004**	**2005**	**2006**	**Average per complete year 2003 - 2006**
January	N/A	177,610	130,201	84,216	130,676
February	N/A	180,644	79,904	87,436	115,995
March	N/A	266,416	83,279	94,469	148,055
April	N/A	185,289	67,739	61,085	104,704
May	37,693*	184,594	74,543	60,554	106,564
June	80,517	176,729	78,601	82,393	104,560
July	131,092	174,307	98,494	42,427	111,580
August	98,926	115,784	99,369	44,887	89,742
September	96,778	151,214	129,479	66,396	110,967
October	107,325	226,865	113,731	90,973	134,724
November	112,456	190,402	138,846	89,728	132,858
December	97,095	148,006	90,990	61,149	99,310
Annual Total	**761,883**	**2,177,861**	**1,185,174**	**865,713**	**1,367,554**

* Note that this figure has been ignored in averaging calculations since the Package 1 Contract commenced in May 2003 and so this figure may not represent data for a complete month.

4.18 The current fee charged for the disposal of inert waste at a licensed quarry under the Package 1 contract is €3.44 (Lm1.48) per tonne including VAT. The fee received by the quarry owner is not available; it is subject to a private agreement between the owner and the Package 1 contractor.

Rehabilitation of disused quarry voids outside Package 1 Contract

4.19 There is no data available on excavation waste placed in quarries outside the Package 1 contract. These are quarries where the placement of inert excavation material is permitted by MEPA either as a result of a specific application to restore the quarry, or as a condition of permit attached to the permission to quarry. No government entity collects such data, and the owners of such quarries are not obliged to report the volumes of waste used to infill the quarries. Industry sources have cited a number of instances of developers purchasing disused quarries or space therein with the intent to use them as a repository for inert waste arising from their own projects, and in one case an owner stopped receiving

[13] Source: WasteServ Malta Ltd.

waste from Package 1 in favour of private arrangements.

4.20 Data on inert waste deposited under the Package 1 contract (See Table 4-2) show a spike in quantity of inert waste received in 2004 that is double that reported to have been received at the Maghtab landfill before 2004 and that received at Package 1 quarries post-2004. WasteServ Malta Ltd advised that it was possible that the spike represents the true quantity of inert waste generation; it based its conclusion on the premise that there was a lag between Package 1 starting to operate (and charge fees for the disposal of inert waste), and the owners of other quarry voids (i.e. outside Package 1) recognising and acting on a business opportunity resulting from the acceptance of inert waste. In the meantime, the vast majority of inert waste was deposited in Package 1 quarries. This premise was confirmed by the Package 1 contractor.[14]

4.21 This premise was tested against changes in the potential supply of inert waste material as reflected in the changes in the number of dwelling approvals by MEPA. While it may be argued that there is a certain lag between approval and excavation, in our experience construction commences very soon after the grant of permission[15]. A substantial change in dwelling approvals, or excavations for major non-residential project would be required to explain the spike.

4.22 No major non-residential project was granted permission in 2003 or 2004, and inert waste from the MIDI private sector housing project was deposited at the official despoliation grounds (rather than in Package 1 quarries) at that time. This would support the WasteServ hypothesis that the spike in waste generated in 2004 represents the true annual quantity of inert waste disposed of on land.

4.23 The annual average quantity of land-disposal inert waste over the period 1998 – 2006 excluding the 2004 anomaly was 1.04 million tonnes. If WasteServ Malta Ltd's premise as described above is correct, it means that the amount of inert waste deposited in private quarries was the difference between the average and the 2004 spike: 1.1 million tonnes. This figure of 1.1 million tonnes has been assumed to be representative of the order of magnitude of the amount of inert waste disposed of in quarries outside the Package 1 contract each year. This figure is an extrapolation from measured data, and as such, has less confidence associated with it than the confidence associated with the measured datasets shown in Table 4-1 and Table 4-2.

Designated despoliation grounds

4.24 Malta's officially designated despoliation grounds, established by Legal Notice 128 of 1997[16]; is located at coordinates 35°55.1'N, 14°34.0'E. The site is located north east of Area 3 in a water depth of the order of 100m. The location of the despoliation grounds is indicated in Figure 4-1.

4.25 The despoliation grounds are subject to a permitting procedure managed by MEPA; MEPA

[14] Discussion with Polidano Group (Mr Boris Farrugia, September 2007)
[15] MEPA advises that 7 percent of approvals are not built.
[16] Environment Protection Act, 1991, Water Services Corporation Act, 1991, Deposit of Wastes and Rubble (Fees) Regulations, 1997.

usually only permits dumping of excavated inert waste material at sea. However, it is understood that inert waste material from the demolition of the Ricasoli Industrial Estate has been dumped at sea. The legal aspects of dumping at sea are addressed in Chapter 14.

4.26 MEPA records show that a total of 857,000 tonnes was deposited at the despoliation grounds between March 2003 and July 2007 inclusive. This results in an indicative annual average of 210,000 tonnes of inert waste dumped at the designated Despoliation Grounds. Such waste has arisen from urban development projects, the Freeport, and Enemalta tunnelling.[17]

4.27 Table 4-3 identifies a number of projects that dumped waste at sea and the approximate waste arisings in the period 1997-2007. The waste is typically loaded onto barges at or near the construction site.

Table 4-3: Projects for which inert waste has been dumped at sea[18]

Project	Year	Amount (tonnes)	Type of Waste
Portomaso (Hilton)	1997 - 1999	175,000[19]	Inert excavation waste some hardstone maybe 70% franka
Portomaso (Hilton)	1997 - 1999	30,000	Dredged material
Cottonera marina	2002 -03	1,000[19]	Dredged material
Cirkewwa Ferry Terminal	2001-03	17,000	Dredged material
MIDI Development (Tigné Point)	2003 - ongoing	820,604	Inert excavation waste
Viset (Pinto Wharf)	2004	34,000[19]	Dredged material
Salina	2005	Unknown	Dredged material
Freeport Oil tanking	2006-2007	70,000	Inert excavation waste
Freeport Dredging	2002 - 2007	10,000	Dredged material
GAP Holdings (Fort Cambridge site)	2007 - ongoing	58,000[20]	Inert excavation waste
Enemalta Tunnels	1998 - ongoing	255,000	Inert excavation waste

4.28 It should be noted that, as shown in Table 4-3, some of the waste deposited at the designated despoliation grounds is dredged material[21], and as such, would not be suitable for use in a reclamation project. There is some uncertainty in the figures provided in Table 4-3, however, as an indication, based on the above figures, dredged material makes up approximately 6% of the total tonnage of material deposited at the despoliation grounds.

[17] It is noted that the Coralline Limestone was recycled.
[18] Source: MEPA, Enemalta, Freeport Terminals Malta Ltd, developers and Victor Axiak: *An Overview of Marine Dumping Activities in Malta*, Axiak Victor, 2005
[19] Axiak notes that this is an estimate.
[20] Up to end August 2007, by which date the excavation was almost complete.
[21] Currently all dredged material (originating from capital dredging schemes, maintenance dredging or environmental dredging) is disposed of at the designated despoliation grounds.

Coastal land reclamation

4.29 Coastal reclamation schemes over the past 10 – 20 years have been driven by land requirements for specific projects. Apart from minor coastal projects such as small quays or jetties, coastal reclamation projects have been sporadic, namely:

- Malta Freeport Terminal 1: commenced operation in 1990, extended in 1995;
- Delimara Power Station: early 1990s
- Malta Freeport Terminal 2: commenced operation in 1997;
- Cirkewwa Ferry Terminal (including extended breakwater and marshalling areas): 1998 – 2001;
- AFM quay extensions at Haywharf, Pieta: 1999 – 2001; and
- Hardstanding area for use by fishermen at Il-Ponta tal-Qretjen, Marsaxlokk: 2006 – 2007.

4.30 The quantity and type of material used as fill in the above projects is summarised in Table 4-4.

Table 4-4: Quantity of infill material for historic reclamation projects [22]

Project	Quantity of fill		Type of material used
	m^3	tonnes[23]	
Freeport Terminal 1	Unknown		Unknown
Freeport Terminal 2	70,000 (from Oil Tanking site)	140,000	Globigerina Limestone
Delimara Power Station: coastal works	Unknown		Unknown
Cirkewwa Ferry Terminal a) Reclamation area backfill b) Breakwater core c) Breakwater armouring	 a) 44,560 b) 43,380 c) 25,700	 a) 89,120 b) 86,760 c) 51,400	Coralline Limestone: excavation waste and quarry-sourced boulders
AFM quay extension, Haywharf	Unknown		Unknown
Hardstanding area, Marsaxlokk	7,000 approx.[24]	14,000	Excavation waste

[22] Source: MEPA, MMA and developers
[23] This data was supplied in m^3 and was converted to tonnes on the basis that compacted bulk density of broken limestone is of the order of $2t/m^3$
[24] Estimate based on the following data: Reclaimed area: $3,500m^2$, depth 0 – 4 metres: average 2 metres @ $3,500m^2$ = $7,000m^3$

Other disposal options

4.31 Some inert waste is currently disposed of through conversion of garrigue to agricultural land. There are no data regarding this aspect, however the quantity of waste involved is believed to be small and the practice is generally prohibited by MEPA.

4.32 Overburden waste at operational quarries is usually stored within the quarry until it is required for restoration and therefore does not enter the waste stream.

Recycling

4.33 In the past Globigerina Limestone excavation waste was widely recycled by the construction industry as described below. There is very limited data about the quantity of material recycled, however, based on the figures detailed below, it is estimated that of the order of 900,000 tonnes of inert waste may currently be recycled annually.

- Road sub-base: Following the changes in the way roads are built and taking account of the guarantee periods, Globigerina Limestone is no longer used as a road sub-base as it does not meet the required specifications.
- Porous backfill: Globigerina Limestone continues to be used as porous backfill. However, its consumption for this purpose is not reported to the authorities and no data regarding volumes exists. It is common practice, however, to retain excavation material on-site for back-filling as required. As a nominal estimate, it has been assumed that 2,500 tonnes per year is recycled in this manner.
- Lean-mix concrete: Interviews with the processors indicate that currently the bulk of crushed Globigerina Limestone is used for lean concrete. It is estimated that about 200,000 tonnes of Globigerina Limestone are consumed each year.[25]
- Torba: Interviews with the major processors indicate that until recently up to a million tonnes may have been recycled each year directly from the excavation sources.[26] However, industry sources advise that changes in building practices have resulted in a decline in the demand.[27] Torba is no longer used in multi-storey apartment buildings, but remains popular in traditional terraced and other housing. Based on the fact that terraced housing accounted for approximately 25% of the dwellings permitted by MEPA over the period 2000 – 2006, the average annual torba consumption could eventually fall to the order of 250,000 tonnes. It is estimated that annual torba consumption is of the order of 700,000 tonnes.
- Changes to standard stone sizes: The Building Industry Consultative Committee

[25] Denis Farrugia (DENFAR Concrete uses about 1,000 tonnes of crushed Globigerina Limestone a week, most of which is used in lean concrete. Mr Farrugia opined that DENFAR commands less than 20% of the market. Assuming that 800 tonnes a week are used for lean concrete and that this represents 20% of the market share, this would equate with an annual consumption (in Malta) of 200,000 tonnes.

[26] Note that the recycled material is delivered direct from the excavation site to the recycling facility without entering the waste stream.

[27] *Torba* is no longer favoured in apartment blocks because a) floors are built at 9 or 10 courses and utility ducting is being incorporated into the floor / ceiling panels, which results in there being either thinner layers of *torba* or its replacement with hardstone (the latter because *torba* tends to maintain its humidity which affects ceramic floor tiles), and b) the use of *torba* on the roof has been reduced in favour of high density polystyrene foam.

reports that it would be desirable to standardise the size of franka stone and concrete blocks, adopting the dimensions: 450mm x 200mm / 220mm – which compares with current sizes of a concrete block - 450mm x 225mm x 110mm, 145mm, 172mm and 220mm, and franka stone – 556mm (21") x 260 x 150mm (6"), 178mm (7"), or 230mm (9").[28] The smaller franka stone sizes, while easier to handle, would result in a greater production of fines and, because the change is relatively small, would not materially increase the yield from softstone quarries. The advantage in respect of waste arisings, however, is that the reduction on stone size would facilitate the re-use of demolition stone, which would in turn reduce the amount for disposal. The adoption of such new standards is not likely to materially affect the amount of inert waste available for use in any potential reclamation project since the vast majority of inert waste is expected to continue to arise from excavations.

4.34 In the future, the amount of softstone available for re-use or re-cycling could be affected by recent developments and research into alternative uses for it. The following developments relating to reconstituted limestone blocks and urban harvesting of stone are pertinent.

4.35 A number of uses of Globigerina Limestone have been investigated in the past, including its use in the manufacture of resin blocks and reconstituted stone and concrete blocks; none of which has proven successful. Asfaltar[29] reported that they investigated the manufacture of resin bricks but found that production was not cost effective. DENFAR[30], in consultation with German manufacturers of concrete block making plants, conducted trials using Globigerina Limestone in the manufacture of concrete blocks. Although concrete blocks could be manufactured, the end product was not suitable for use. It was found that Globigerina Limestone needed to be washed before use to eliminate dust, relatively large quantities of cement was required both of which added to the costs, and when the blocks were subjected to the pressures usually extant in construction, the spalls either crushed or split, resulting in disintegration of the block. Compression tests showed that for blocks manufactured with a cement content similar to blocks made with hardstone, (which is deemed to be an economically feasible amount) resulted in a compression value of 4N/mm^2, which compares with a value of 7N/mm^2 for C15 concrete. Other major stakeholders[31] have also confirmed the above findings regarding reconstituted stone and concrete blocks manufactured with Globigerina Limestone.

4.36 Cutting technology recently available in Malta has the potential to revolutionise the excavation of urban sites, see Figure 4-2. Through the use of this technology, it is possible to cut substantial stones to a depth of at least 3 storeys in each cut, with no vibration, sound levels that permit normal speech next to the cutter, and cutting can be undertaken within millimetres of adjacent buildings. If three such machines are deployed simultaneously, excavation pace would be comparable with the traditional hydraulic hammer approach. The challenge with the technology arises from the marketing of the cut blocks. The potential use of the stone ranges from using the raw cut blocks for retaining

[28] Legal Notice 47. 1976 of 533 states that the length of the blocks to be used in building cannot be larger than 508mm (20").
[29] Personal communication Perit Sandra Vassallo of Asfaltar Ltd.
[30] Personal communication Denis Farrugia.
[31] Personal communication Boris Farrugia of Eco Ways Ltd / Polidano Ltd.

walls, to further processing off-site for building stone, facing stone, decorative stone and sculpting materials, and possibly the export of good quality stone[32] – which would realise very good returns compared to the current building stone retail prices in Malta. Provided the marketing challenge is resolved, the deployment of such technology would substantially decrease the amount of inert Globigerina Limestone that would otherwise need to be dumped. If, for example, the construction industry were to adopt such technology because of the environmental benefits one could envisage that the amount of Globigerina Limestone for disposal would reduce substantially.

Figure 4-2: New stone cutting plant in operation ***Close-up of cutting blade***

Summary

4.37 The foregoing statistics are summarised to ascertain a baseline estimate of the annual quantity of waste globigerina material currently produced in Malta.

[32] The export of building stone was banned under an agreement negotiated with the EU during Malta's Pre-accession negotiations.

Table 4-5: Average annual quantity of inert waste disposal

Disposal Route	**Estimate of annual quantity of waste disposed of (millions of tonnes)**	**Comment**
Licensed quarries under Package 1 contract	1.1	Based on measured data from Package 1 contract
Unlicensed quarries outside Package 1 contract	1.1	Extrapolated therefore includes a high level of uncertainty
Designated despoliation grounds	0.2	Based on monitored data, but includes dredged material which would be unsuitable for use in reclamation.
Recycling	0.9	Estimate based on anecdotal evidence and therefore includes a high level of uncertainty
Total	**3.3**	

4.38 Figure 4-3 is a mass balance diagram illustrating Table 4-5. It can be seen that the total amount of inert waste which is not usefully recycled is between 1.3 and 2.4 million tonnes annually. This roughly equates (depending on how it is processed) to a volume of around 0.6 to 1.2 million m^3 per year.

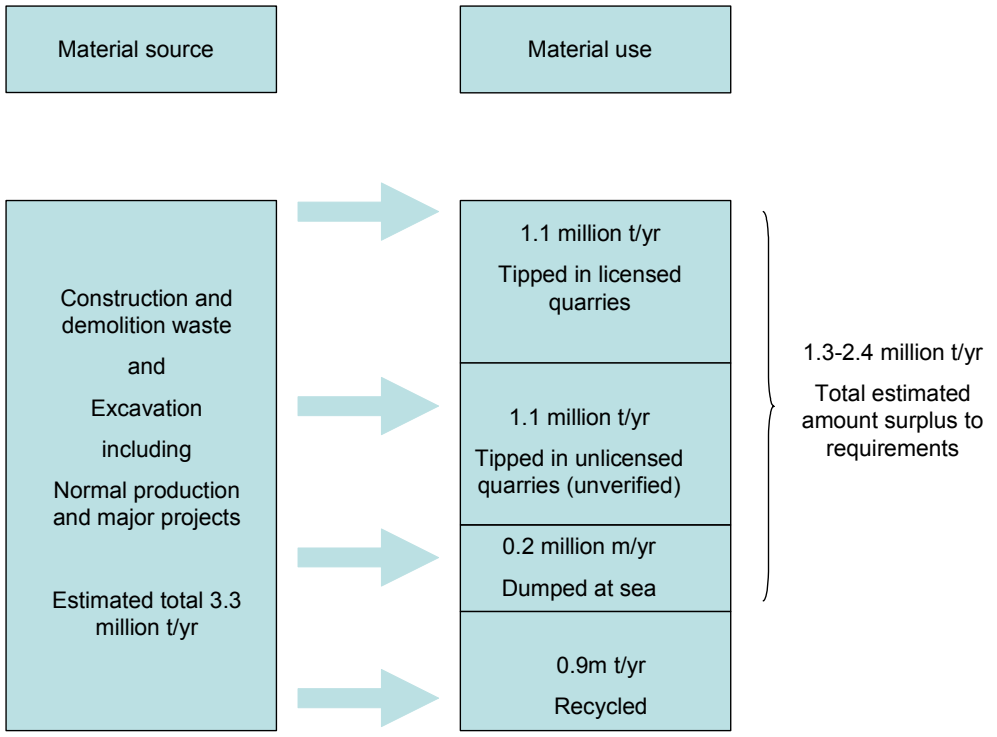


Figure 4-3: Existing mass balance for inert waste

Potential Future Generation Rates of Inert Waste

4.39 Information on the sources, destinations and volume of the waste stream is sparse and not wholly reliable. Apart from the acceptance of waste at licensed quarries, where tonnage is monitored and recorded, most information is anecdotal, incomplete or inferred. This makes both assessment of the case for land reclamation and development of a preferred approach less precise. One of our key recommendations is that more complete records are introduced for the entire waste stream. These records should be collated in a central database allowing analysis of quantity of waste produced as well as its source and disposal locations.

4.40 The approach to disposal seems somewhat inconsistent with large projects being given dispensation to dump at sea and small projects tipping in disused quarries with no apparent overriding view on why this should be. This makes provision for acceptance of surplus materials at a land reclamation scheme more problematic; supply cannot be guaranteed.

4.41 The Waste Management Subject Plan allowed for a 3%-4.25% increase year on year in waste creation until 2010, to account for increased economic activity. Although this is a notional link, and it is not clear that inert waste generation is linked to economic activity, it is prudent when considering the upper bound of waste generation to assume that waste generation would increase with the size of overall economic activity. It is also prudent to

assume that the amount used in recycling may change over time, either downwards as described previously as more efficient methods of excavation are introduced, or upwards due to reducing demand for traditional materials such as torba. However, there is no firm basis for making any of the assumptions and so forward planning needs to be based on a sensitivity analysis. Table 4-6 shows postulated upper and lower bounds for surplus Globigerina availability in 10 years time.

Table 4-6: Average annual quantity of inert waste disposal by 2018 – upper and lower estimates

Disposal Route	Current quantities of surplus Globigerina (millions of tonnes)[33]	2018: Lower estimate of annual quantity of surplus Globigerina (millions of tonnes)	2018: Upper estimate of annual quantity of surplus Globigerina (millions of tonnes)
Total quantity of surplus Globigerina	2.2-3.3	2.2	4.3
Quantity of Globigerina that is recycled	0.9	1.3	0.5
Net quantity of Globigerina potentially available for land reclamation	1.3-2.4	0.9	3.8

4.42 Table 4-6 assumes that for the lower bound estimate of surplus Globigerina available in 2018, the amount produced is at the lower bound of the current production range, and that recycling increases from current figures by 50%. For the upper bound estimate of surplus Globigerina available in 2018, the amount produced is at the upper end of the of the current production range, plus a 30% increase to allow for economic activity over the period to 2018, and recycling is assumed to reduce by 50%.

4.43 Figures 4-4 and 4-5 are mass balance diagrams illustrating Table 4-6. It can be seen that the total amount of inert waste which is not usefully recycled is between 0.9 and 3.8 million tonnes annually. This roughly equates (depending on how it is processed) to a volume of around 0.5 to 2 million m^3 per year. This is a very wide range, illustrating the uncertainties involved in planning for the inert waste stream.

[33] There is a range given for current quantities of surplus Globigerina; the upper end of the range is taken from the figure given in Table 4-5 representing total annual surplus Globigerina production (3.3 million tonnes per year). The lower end of the range is based on the fact that an estimated 1.1 million tonnes are deposited in unlicensed quarries outside the Package 1 contract (Table 4-5) and this data is not officially recorded or monitored in any way so could in reality be significantly higher or lower than the estimated figure of 1.1 million tonnes. For the lower end of the range given for current annual quantities of surplus Globigerina being produced, it was assumed that no material is currently being deposited in unlicensed quarries outside the Package 1 contract, resulting in an average generation rate of 2.2 million tonnes per year. (This is clearly a conservative assessment.)

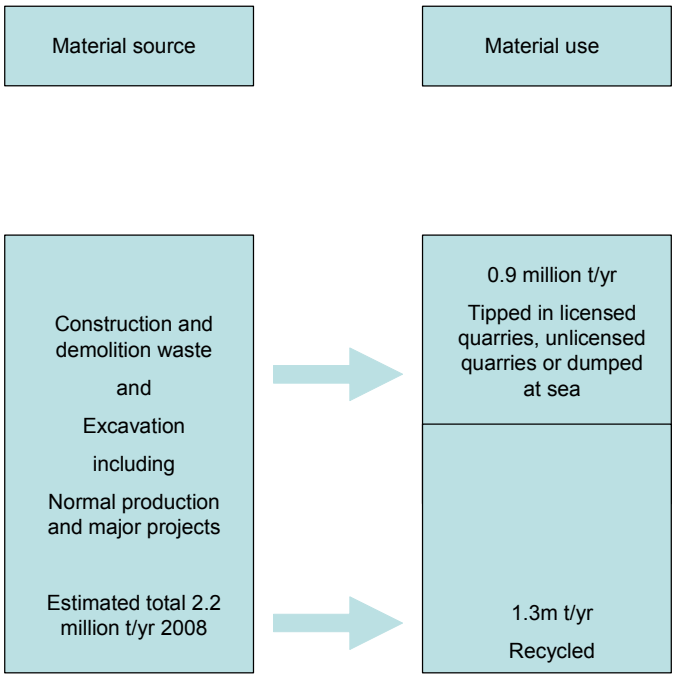


Figure 4-4: Postulated mass balance for inert waste by 2018, showing lower bound on excess waste material

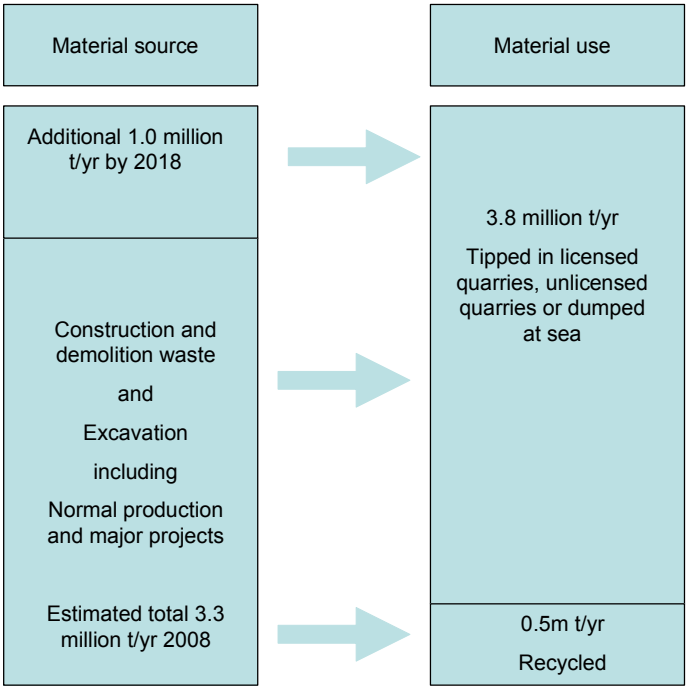


Figure 4-5: Postulated mass balance for inert waste by 2018, showing upper bound on excess waste material

5 International Practice in Use of Waste Materials for Reclamation

5.1 Research into reclamation schemes which would have similar characteristics to an inert waste land reclamation project in Malta has been carried out to identify those constraints which proved critical for other projects and to learn from the experience of other reclamation schemes.

Case Studies

Extension to Malta Freeport

5.2 Information regarding Malta Freeport was kindly supplied by Architect Joseph Bugeja, General Manager of Malta Freeport Terminals Ltd, during a meeting held 5 September 2007.

5.3 Malta Freeport Phase 2 consists of a container terminal including 1.5km quay and a container yard with a footprint of 700m x 300m suitable for annual throughput of 1,000,000 TEUs. The development is constructed on reclaimed land.

5.4 For construction, Malta Freeport decided to use surplus excavation material for fill rather than virgin material and so their experiences are directly pertinent to this Study. It was found that some pre-treatment of fill was needed depending on how the fill was used.

5.5 The reclamation containment structure is formed of two hundred interlocking circular steel sheetpile cells 22m in diameter, which were filled with the Globigerina fill. For this purpose it was found that pre-treatment of the fill was needed. The fill material arriving at the site had a fines content of approximately 30% and this was sieved to reduce the fines content to approximately 12%, it was then vibro-compacted to achieve the density required for stability. This method of construction was selected in preference to a concrete caisson structure due to time constraints.

5.6 The Globigerina was also used as fill within the reclamation containment structure. However, in this case sieving was not required since the quality of the fill was not so critical. This general fill was dynamically compacted on a grid system using a 25 – 30 tonne block dropped from a height. This treatment had a zone of influence of approximately 15m. In general, (regardless of its source) Globigerina tends to powder on slow compression but maintains angularity on shock treatment. Generally, no other treatment was required for the general fill. Settlement has been of the order of 10cm since 1998.

5.7 Of the order of 4.5 million m^3 of fill material was required during construction, of which more than 3 million m^3 was made up from general inert material accepted at the site over a 2-year period. The majority of the inert waste delivered to the site was accepted with

approximately 5% rejected on quality grounds. A quarry was also opened up within the site to supply fill material for the project; the main driver for opening the quarry was the need to reduce the fines content in the fill material, as well as the volume of fill required within the project's timescale.

5.8 The circular sheetpile cells were located in an area where the seabed was at a depth of 10m – 16m, with the bedrock horizon at –15m to –30m. No seabed overburden was removed prior to construction; consolidation and settlement is expected to occur for approximately thirty years after construction. It was necessary to pre-fracture the Globigerina bedrock before the sheetpiles were driven into the seabed.

5.9 Corrosion was estimated to be of the order of 0.3mm per year for the steel sheetpiles and so a corrosion allowance was included in the design. In addition, a 1m high concrete ring was cast on the inside of the steel sheetpile cells in the splash zone, where the corrosion rate will be highest.

La Collette Reclamation Phase 2: States of Jersey

5.10 The island of Jersey is a British crown dependency situated off the coast of France covering an area of 116km² with a population of approximately 88,000 and as a small island, Jersey faces similar problems with waste disposal to Malta. A series of coastal land reclamation schemes have been implemented to dispose of inert waste. Details of the design scheme and construction techniques used for the reclamation edge protection have been published in a technical paper[34]. In addition, further information has been provided by the Transport and Technical Services Department, of the States of Jersey[35]. Some key points from this research are presented below:

- Jersey generates some 400,000 tonnes of inert waste material per year.
- Jersey has undertaken a series of reclamations over recent decades with the primary objective of disposing of waste (rather than land creation being the driving force). The first reclamation (finished 12 years ago) resulted in 156,000m² of reclaimed land. Filling of the current reclamation (known as La Collette Phase 2) commenced in approximately 1998 and is designed to produce approximately 350,000m² reclaimed land.
- The reclamations have been formed as a coastal extension protected by a rock armour breakwater around the reclamation boundary. The breakwater was constructed and funded entirely by the States of Jersey government and infilling of the reclamation commenced once the edge protection structure was entirely finished.
- The reclamations have been constructed almost entirely in the inter-tidal area (tidal range in Jersey is over 12m) on a rocky foreshore of granite and diorite.
- Today, the area below the reclamation would be considered very ecologically rich

[34] Coastlines, Structures and Breakwaters. Thomas Telford, London, 1998
[35] Telephone conversation between Laura Mitchell of Scott Wilson and Quentin Murfin of Transport and Technical Services Department, States of Jersey took place 3 July 2007.

but at the time the project was approved, environmental legislation was far less onerous than today; Relevant discussions suggest that the reclamation may not have obtained approval today on environmental grounds.

- Construction of the rock armour breakwater was programmed so that the area most exposed to wave attack was constructed first so that the remainder of the works were afforded protection by this part of the structure during the rest of the construction programme.
- Inert waste and demolition rubble is tipped into the reclamation and moved around by bulldozers. There is no other form of engineered compaction.
- The reclamation fill is inert material – a mixture of subsoils, demolition rubble, badly mixed stone, old concrete etc. As the reclamation has progressed, recycling initiatives have increased so the waste is now sorted to re-use or recycle bricks, concrete and other useful materials. As a result, the amount of fill is reducing and its quality is reducing too.
- Users are charged for using the site to cover the running costs. Charges from January 2007 are approximately: €5.36 (LM 2.30) per tonne for segregated inert waste; €15.37 (LM 6.60) per tonne for non-segregated waste and there is no charge for disposal of less than 500kg of waste.
- Once the reclamation is complete, it is sold to developers (Waterfront Enterprise Board). There is no phasing; development only takes place once the reclamation is completely finished. During planning and construction of the reclamation, there is no consideration of what development may eventually take place or any constraints imposed by the end-use.
- The first reclamation consisted of approx 6m depth of fill and was developed to provide car parking, a leisure centre, harbour operation area, hotel, marina etc. It is understood that the foundations for structures were piled onto the underlying bedrock.

Proposed Artificial Island, Hong Kong

5.11 Scott Wilson was the lead consultant in a feasibility study to define recommendations for the "long-term arrangements for the accommodation of construction and demolition materials and dredged mud in Hong Kong". Although there are a number of issues relating to this project that are specific to the project location (such as the presence of thick alluvial deposits and exposure of the site to typhoon conditions), there are also some more generic features, from which lessons could be taken for any reclamation project. Some key points originating from a review of the Hong Kong project are presented below:

- The scheme is planned to take place over a long timescale: construction is proposed to commence in 2010 and be complete to formation level by 2035. In this case, the long construction period is partly to build pauses into the programme to allow the thick alluvial deposits to consolidate and gain strength and also to reflect the fact that there is no control of the rate at which material will be produced. Although the geotechnical constraints will not be encountered in Malta, the flexibility

in programme will be still be important as it can affect the level of interest from private developers in investing in the scheme from the outset.

- Because of its history of managing and utilising waste materials, Hong Kong does have a good integrated system for waste management including hard infrastructure, such as weighbridges, barging points, sorting facilities etc as well as soft infrastructure, such as systems for measuring and categorising volumes and types of materials, tracking movements, etc.
- The Hong Kong reclamation scheme was designed to accommodate a wider range of material than that proposed for Malta. The process developed for sorting the different types of materials (including vibrating screens, magnetic separators, crushers etc) may be useful following further clarification of the sources and properties of the Maltese waste material.
- The Hong Kong reclamation scheme is designed to be constructed in a series of cells, with the walls of the cells constructed from screened, hard, inert construction and demolition material and the cells subsequently filled with unscreened construction and demolition materials and dredged muds. The cellular structure allows flexibility for varying the final shape of the island if availability of materials differs significantly from the forecast volumes.
- Preliminary calculations indicated that the material properties of the fill would not be sufficient to maintain local stability of the seawalls resulting in the adoption of a selection policy to ensure adequate material quality is achieved within selected areas adjacent to seawalls and other sensitive areas. It was recommended to include inclinometers within the reclamation in rows along the seawalls to provide an early indication of movement to prevent toe failure of the walls. Other instrumentation was also recommended to be included in the structure, to allow measurement of pore water pressures, settlement etc.
- Recommended construction techniques included the use of geosynthetic tubes filled with construction and demolition materials to contain fine fill material and act as a filter between the core and the outer armour for rubble mound structures.
- The reclamation was intended to be self-sufficient in terms of energy with a waste-to-energy plant and solar panels incorporated into the island masterplanning.
- A number of afteruses were considered for the reclamation development, including residential development, commercial development, government/community usage, port development, agriculture/forestry, landfill, a potentially hazardous installation or recreation/eco-tourism.
- Measures to reduce the negative environmental impact were considered at all stages in the design. Measures included the use of screening elements, such as landscaped mounds to reduce the visual impact of some elements of the site and reduce noise pollution. Advice from ecologists was sought early in the project to ensure the provision of beneficial habitats (such as wetlands, mudflats, artificial reefs etc) were built into the reclamation scheme. Construction procedures were specified to limit damage to the environment (such as the use of a floating boom during construction, minimising dredging etc).

- The Hong Kong project team estimated on the basis of previous breakwater projects that maintenance costs account for 0.75% of capital costs. This emphasises the need to consider the full-life costs of the structure at the design stage.
- The Hong Kong project set out a number of recommendations, to accommodate including short, medium and long term arrangements. The construction of a reclamation was one of those recommendations, recognising that the long term goal is to achieve a materials balance within HK or the wider Pearl River Delta area.

6 Reclamation Placement Options

Overview

6.1 Two generic types of option for use of waste materials for marine reclamation have been identified:

- Creation of new land, through extensions to the existing plan shape of Malta or creation of new islands;
- Creation of below-surface land, otherwise known as reefs or submerged islands;

6.2 In addition, there is a third option for disposal, which is simply marine dumping, without the intention of creating land or a specific submerged structure.

Submerged Land

6.3 Creation of submerged land or submerged islands is not an obviously useful activity. The Project Identification Report (2005) considered the use of submerged land as a base for supporting wind farms, and concluded that it would be prohibitively costly. We concur with that finding; offshore wind farms consist of widely spaced wind turbines, of the order of 300m apart for the largest and most modern types, each of which requires a relatively small but structurally robust foundation. Between the turbine masts there is no need for a foundation. It is unlikely that a very extensive submerged platform formed in relatively weak material would be a worthwhile component.

6.4 No other credibly viable uses have been identified for a submerged platform. In addition, our experience in the marine environment leads us to conclude that construction of submerged reclamations would actually be more difficult and costly than above-surface reclamations, due to the difficulties of placement of material and construction of edge protection without a land platform from which to work. Therefore submerged land reclamation has not been taken further in this study.

6.5 It has been suggested that marine reefs could be constructed using the waste material[36]. This is technically possible, providing that a binding material is used to create a solid block or shape, which can then be used as a component of a reef. The process of constructing the blocks and placing them in the sea would be very much more costly per cubic metre of fill than bulk placement (see paragraph 4.35), and this activity is not suited to placement of fill on a scale of several million tonnes. The aim of a marine reef would be to enhance marine ecology, and the benefits of creating the reefs would need to be justified through a specific study of these issues. It may be a viable use for a part of the waste stream.

[36] This issue was raised during the stakeholder workshop – notes from the discussions at the workshop are reproduced in Annex A of the Appendices.

Marine Dumping

6.6 Marine dumping does not in itself create land. However, this option has been retained as a comparator against the land reclamation options, because it is an ongoing practice (albeit at a relatively low level of activity – see Chapter 4) and because it is in direct contrast to the reclamation approach:

- Land reclamation is a relatively high-cost option, with a potential for cost to be offset by the value being generated by land creation;
- Dumping is low-cost with no value being created.

6.7 Dumping has been used for many years to accommodate waste material, and appears to be the method of choice for large, one-off construction projects. Dumping takes place at the designated despoliation grounds as described in Chapter 4. MEPA has commissioned a survey of the dump site to evaluate the extent of the footprint pf the dumping, and its impact on adjacent sea-bed areas. Dumping could in principle take place at other locations if they were suitably designated by Government, but looking at these alternatives is outside the scope of this report.

Emerged Reclamations – Islands and Land Extensions

6.8 In assessing the technical feasibility of land reclamation, a number of factors must be considered, primarily:

- Construction methods;
- Construction materials; and
- Location and size of reclamation.

6.9 Chapter 7 presents an assessment of construction methods and materials, based on a review of both current Maltese practice and international experience. Chapter 7 identifies a number of possible methods for protection of a reclamation against the action of waves and tides, and two methods for placement of the fill – either by tipping from land or by dumping from a barge.

6.10 The materials to be used for the bulk of the reclamation are the inert waste which is the subject of this study.

Location and size of reclamation

6.11 The Project Identification Report presented some very preliminary work on land reclamation options. One of the components was the presentation of abstract concepts for artificial islands – circular islands of varying size, and located in varying depths of water. For these islands, graphs of cost versus depth or size were presented. This information was a useful introduction to thinking about the issues of reclamation, but could be misleading in the sense that abstract concepts cannot be used to optimise the reclamation

to arrive at the most viable outcome, or even to compare options. This is because abstract conceptual options did not take account of the actual physical constraints of Areas 1 and 3, such as sea bed levels.

6.12 In both Areas 1 and 3 there is limited space at any given depth of water. Therefore the Carl Bro graphs which suggested that it would be possible to optimise a reclamation by selecting a large island in shallow water were flawed in relation to Areas 1 and 3, as it is not possible to create such an island in shallow water – there simply isn't the area available. In both Areas 1 and 3, it is to possible create relatively small reclamations in shallow water but large reclamations have to be located in deeper water.

6.13 Therefore the process of assessing the feasibility of reclamation needs to start with assessment of 'real' options, taking into account the bathymetry and geometry of the available sites.

6.14 To be of significance in relation to the waste stream, a reclamation scheme must be able to 'absorb' a number of years' surplus quantity of Globigerina. As set out in Chapter 4, the current annual production of surplus Globigerina which would be available for a reclamation scheme is of the order of 1.3-2.4 million tonnes, or 0.7-1.2 million m^3 (using a notional density as placed of 2t/m^3). This means that a reclamation layout must have a volume of at least several million cubic metres. Approaches of a lesser size than this were discarded as being peripheral to the main issue of whether land reclamation is a viable end use for the inert waste being generated.

6.15 Similarly, it would be very risky to attempt to develop a land reclamation which is so large that it would take many tens of years to be complete. As a result, upper and lower bounds of 5 million m^3 and 20 million m^3 were identified as limits on a realistic reclamation scheme in Malta. Based on seabed bathymetry data, potential shapes were identified which could be reclaimed; three sizes of reclamation were considered: 5, 10 and 20 million m^3. These reclamation sizes provide a capacity of 4-8 years, 8-15 years and 17-31 years respectively using the current estimates of Globigerina generation rates. Using the lower bound estimate of Globigerina generation rates from Chapter 4 for 2018 (0.9 million tonnes) these three reclamation sizes would provide approximately 10, 20 and 40 years capacity whereas using the upper bound estimates (3.8 million tonnes) would provide 2.5, 5 and 10 years capacity.

6.16 Unlike many engineering projects, which have a single fixed objective (for example – a highway with a certain transport capacity) around which a solution can be optimised and then assessed for viability, a project utilising waste to create reclamation has a number of objectives (for example - creation of land, storage capacity for waste) which potentially create competing priorities, making optimisation more difficult. Therefore our approach was to generate a range of land reclamation shapes which prioritised different aspects, such as maximising land creation for a given volume of waste material, and maximising storage capacity for waste material within a given footprint area.

6.17 Because of the significance of the cost of edge protection to the total cost of a reclamation scheme, and the rapidly increasing cost of edge protection with depth, the initial approach was to generate shapes which provided the required volume at minimum depth. This

generated shapes which extend contiguously from the shore and tend to be relatively long and narrow.

6.18 These shapes were then supplemented with ones which extend out into deeper water, but no deeper than the -20m contour, providing the same volume in a wide, shorter, overall smaller footprint, shape. The reason for selecting the -20m contour as a limit was that this is considered to be the deepest practicable limit for normal breakwater and reclamation construction – as described in Chapter 7.

6.19 In the case of Area 1, a shape was added which is an island, separated from the mainland of Malta. This could conceivably create added land value through its separation from the mainland. In Area 3, the bathymetry is steeply shelving meaning that there is no physical space for a sufficiently large island within the –20m contour. However, at the stakeholder workshop (see Annex A of the Appendices), it was requested that an artificial island sited on the shallow area created by a disused spoil ground at the eastern end of Area 3 be considered as one of the options. This is included as shape 3g in Table 6-2.

6.20 In Area 1, a further shape was added which does not fit the parameters set out above, but was selected because from an engineering perspective it appeared to offer the prospect of a very cost-effective solution. This was a proposal to fill in the inlet at Qalet Marku. From a practical viewpoint this shape was adopted because it would have the lowest cost per tonne of material taken and per square metre of land created due to the geometry of the inlet. Again, there was no suitable site within Area 3 for such an option.

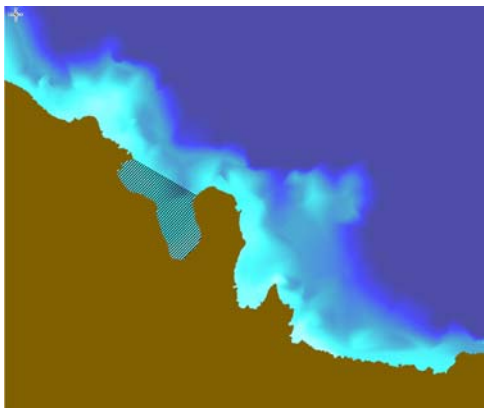
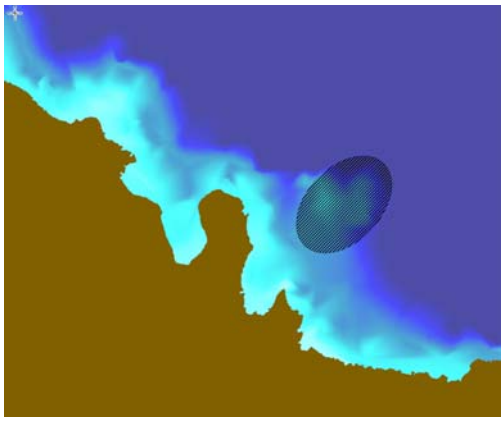
6.21 In all cases, a notional top level of the reclamation was set at +5m CD. This is sufficiently high to provide protection against inundation and flooding, and allows direct comparison of options. It should be note however, that this is not a limit, as much higher levels could be constructed, and this would accommodate greater volumes within the same area . If the objective is to maximise creation of land for unit cost of construction, then the +5 approach would be preferred. However, if the objective is to maximise absorption of inert waste to reduce pressure on capacity of quarries then a higher level would be preferred.

6.22 In all, the shapes range in area from 17 to 144 ha and from a notional fill volume of 1.6 million to 20 million cubic metres. The shapes are shown in Figures 6-1 and 6-2. A GIS approach was used to determine the shape boundaries required for each fill volume, and the resulting land area created.

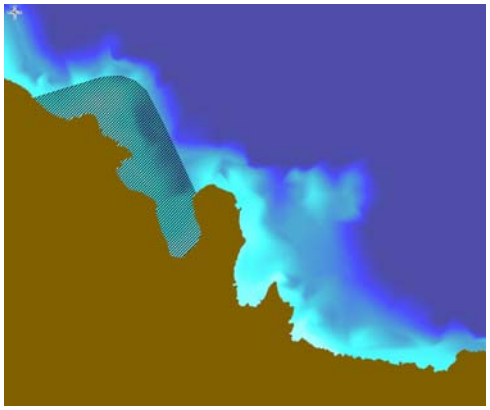
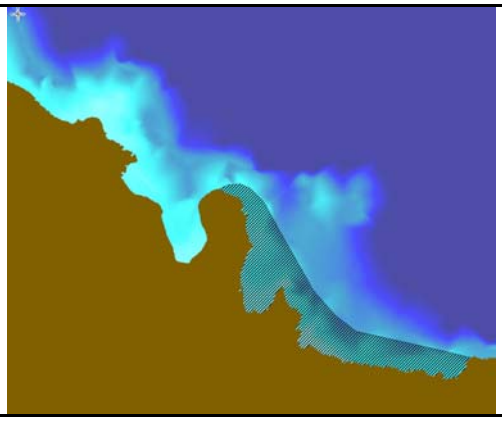
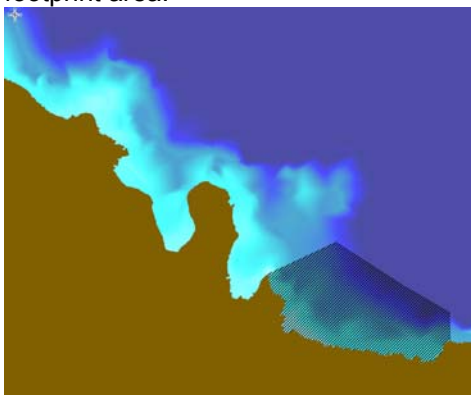
Land reclamation shapes – Area 1

6.23 A total of five reclamation shapes have been generated for Area 1, as shown on Figure 6-1.

Table 6-1: Description of reclamation shapes generated for Area 1

Shape	Description	Plan Area (m^2)	Waste volume capacity[37] (m^3)	Comments
1a	Inlet infill, formed by constructing edge protection across the mouth of the inlet at Qalet Marku	170,000	1.6 million	Because the length of edge protection is relatively short, and in shallow water, for the area impounded, this option could potentially provide a least cost, 'quick start' option. 
1b	Island in shallow water	292,000	5 million	Only feasible island option in Area 1 

[37] For notional top level of reclamation at +5mCD.

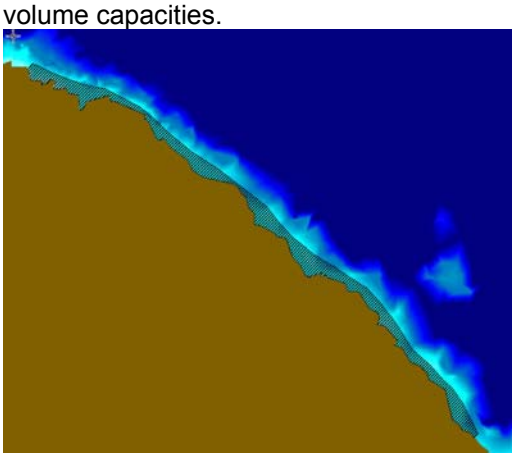
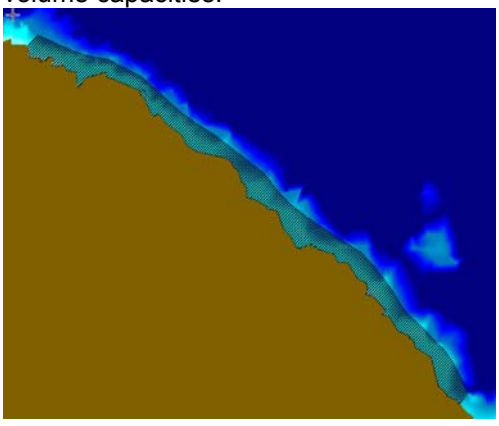
1c	Linear reclamation along northern part of study area 1	439,000	10 million	This is the greatest area of shallow water, potentially optimising land creation for the given fill volume. Edge protection hugs –10mCD contour. 
1d	Linear reclamation along southern part of study area 1	487,000	5 million	
1e	Deep reclamation in southern part of study area.	663,000	10 million	Water depths are greater here, potentially optimising waste volume capacity for the given length of edge protection and footprint area. 

6.24 These shapes were taken forward to the economic assessment and environmental appraisal parts of the study.

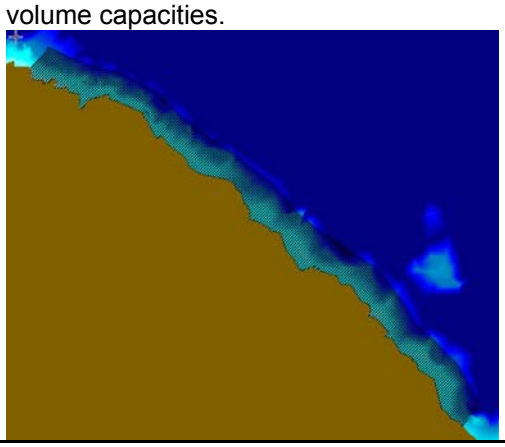
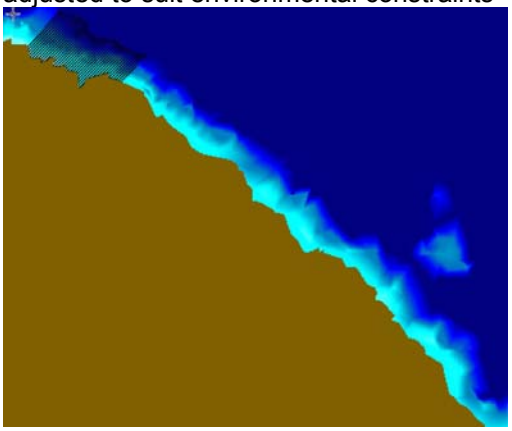
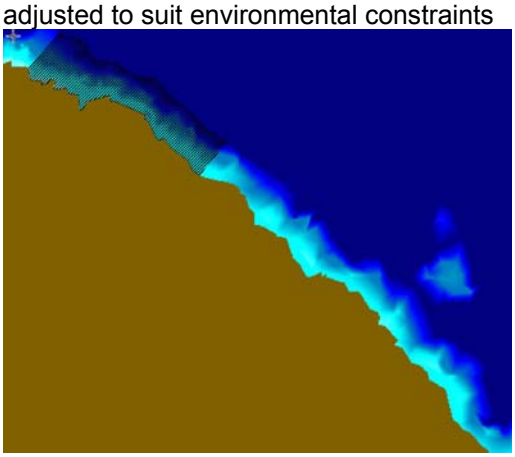
Land reclamation shapes - Area 3

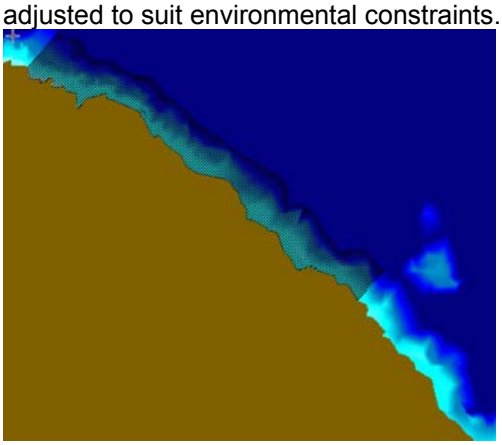
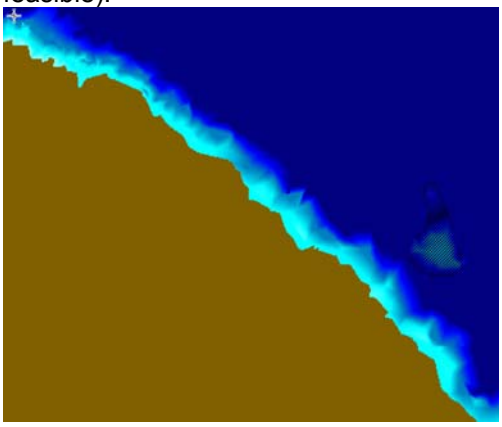
6.25 A total of seven reclamation shapes have been generated for Area 3, including one shape requested by one of the stakeholder workshop participants. The seven reclamation shapes within Area 3 are shown on Figure 6-2.

Table 6-2: Description of reclamation shapes generated for Area 3

Shape	Description	Plan Area (m^2)	Waste volume capacity[38] (m^3)	Comments
3a	Linear reclamation along majority of Area 3 coast	490,000	5 million	Shapes 3a, 3b and 3c only differ in that they extend seawards by differing amounts and hence have different fill volume capacities. 
3b	Linear reclamation along majority of Area 3 coast	876,000	10 million	Shapes 3a, 3b and 3c only differ in that they extend seawards by differing amounts and hence have different fill volume capacities. 

[38] For notional top level of reclamation at +5mCD.

3c	Linear reclamation along majority of Area 3 coast	1,442,000	20 million	Shapes 3a, 3b and 3c only differ in that they extend seawards by differing amounts and hence have different fill volume capacities. 
3d	Reclamation to -20m contour in northern part of Area 3	332,000	5 million	The exact position of this shape can be adjusted to suit environmental constraints 
3e	Reclamation to -20m contour in northern part of Area 3	627,000	10 million	The exact position of this shape can be adjusted to suit environmental constraints 

3f	Reclamation to -20m contour in northern part of Area 3	1,271,000	20 million	The exact position of this shape can be adjusted to suit environmental constraints. 
3g	Reclamation on shallow area within Area 3 on site of disused spoil ground	246,000	4.7 million	This shape accommodates a smaller quantity of fill material than all but one of the other shapes. The edge protection structures are in water depths of the order of 20m (at the limit of what is technically feasible). 

6.26 Cost estimates were produced for each of these shapes and these were taken forward to the economic assessment part of the study.

6.27 One of the key points to note from this exercise is that the shapes do not represent the total number of possible shapes which might be created – that is effectively infinite. As well as it being possible to come up with further variations on these shapes, it would also be possible to combine them in many different ways. The range of shapes serves two important functions:

- It shows a range of possible approaches which, when taken together, represent an envelope of possible shapes. Therefore any substantial sea area outside the total envelope is unlikely to be technically viable, and this is an important consideration

in filtering down possible locations of reclamation. (It should be noted that variants of reclamation shapes 3d, 3e and 3f could be located further east along the Area 3 coast, so the envelope of possible shapes should be stretched to include areas up to the –20m contour in Area 3.)

- It encompasses enough variation to represent a sensitivity test on key parameters. This supports (in Chapter 12.25 describing the economic analysis) an assessment of whether one type of shape is inherently more economically viable than another.

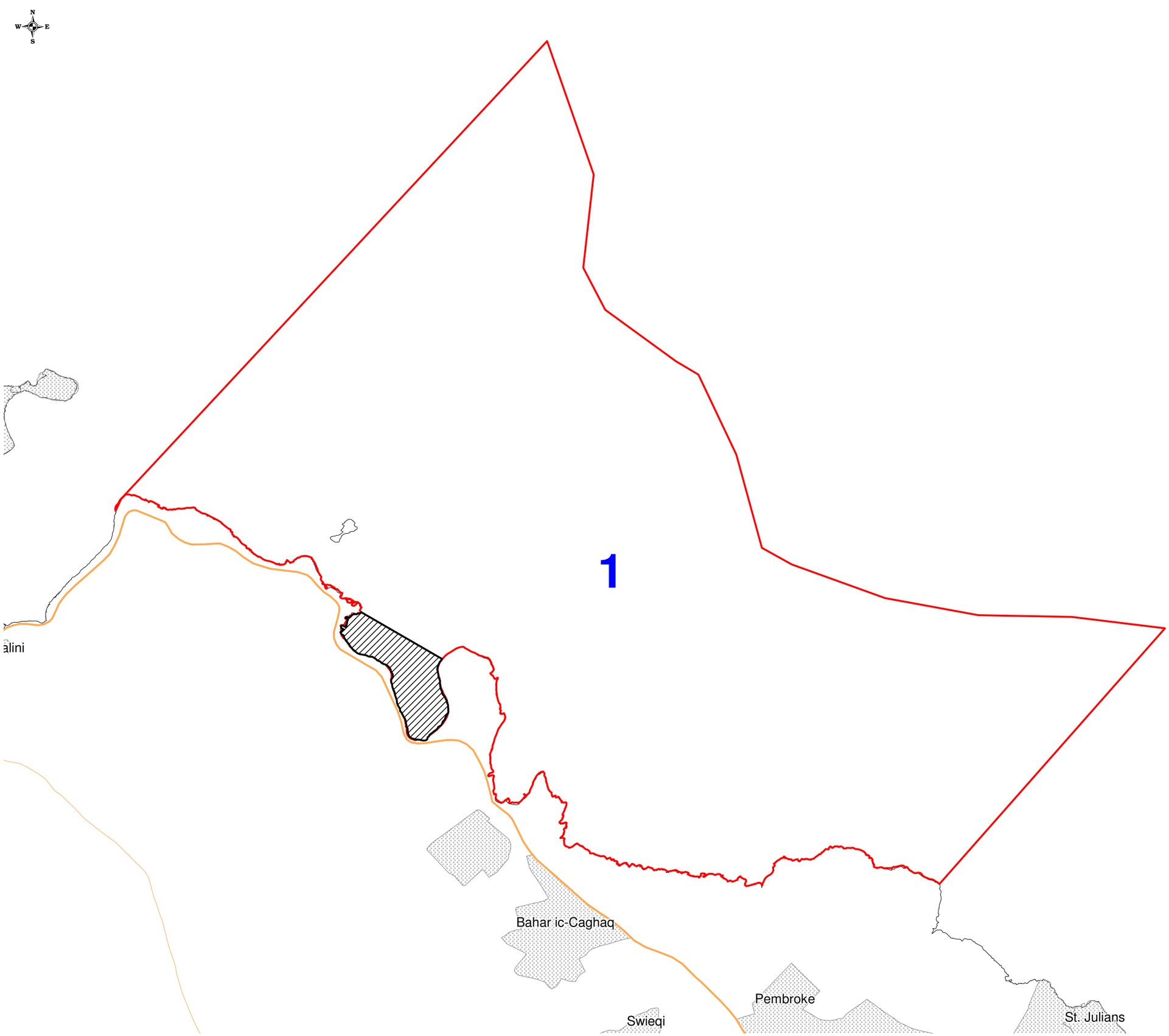
Setting Reclamation Level

6.28 At the design stage of a specific reclamation scheme, it will be necessary to select the finished level of the reclamation. This will affect how much fill material can be absorbed by any given reclamation shape and may also impact on the after-uses for which the reclaimed land will be suitable.

6.29 In setting the reclamation level, it will be necessary to consider the effects of sea level rise due to climate change. The Physical Oceanography Unit at the International Ocean Institute's Malta Operational Centre (University of Malta) has recently started monitoring sea level changes. The First Communication of Malta to the United Nations Framework Convention on Climate Change (2004) states that current trends indicate a 1cm per year local sea level rise resulting in a sea level rise of 50cm by 2050 and 100cm by 2100.

6.30 Malta is likely to be particularly vulnerable to the effects of sea level rise because of its small tidal range. Increased sea levels will result in the inundation of low-lying coastal areas. The First Communication of Malta to the United Nations Framework Convention on Climate Change (2004) identifies Malta's northeastern coastline (i.e. Areas 1 and 3) as being particularly vulnerable.

6.31 The design process will involve selection of a design sea level taking into account the most up to date sea level rise predictions available. The design sea level should be used to set the reclamation level to ensure that flooding of the reclaimed area will not occur under design conditions. The edge protection structures should be designed taking account of wave overtopping of the defences during storm events.



Notes

Search area boundary

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 1: SHAPE 1A

SCALE AT A3:

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FIGURE NUMBER:

FIGURE 6-1A

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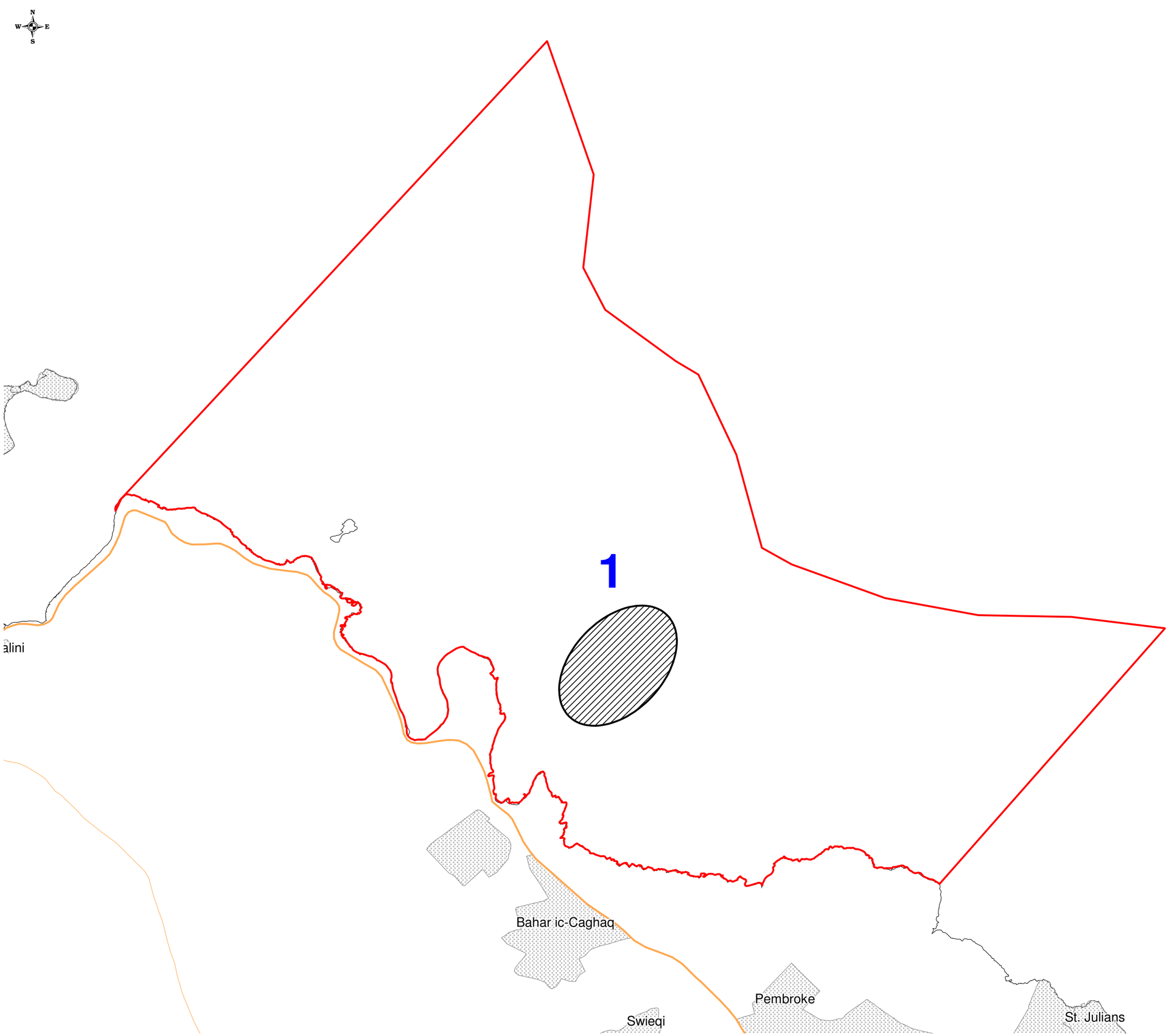

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 1: SHAPE 1B

SCALE AT A3:

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FIGURE NUMBER:

FIGURE 6-1B

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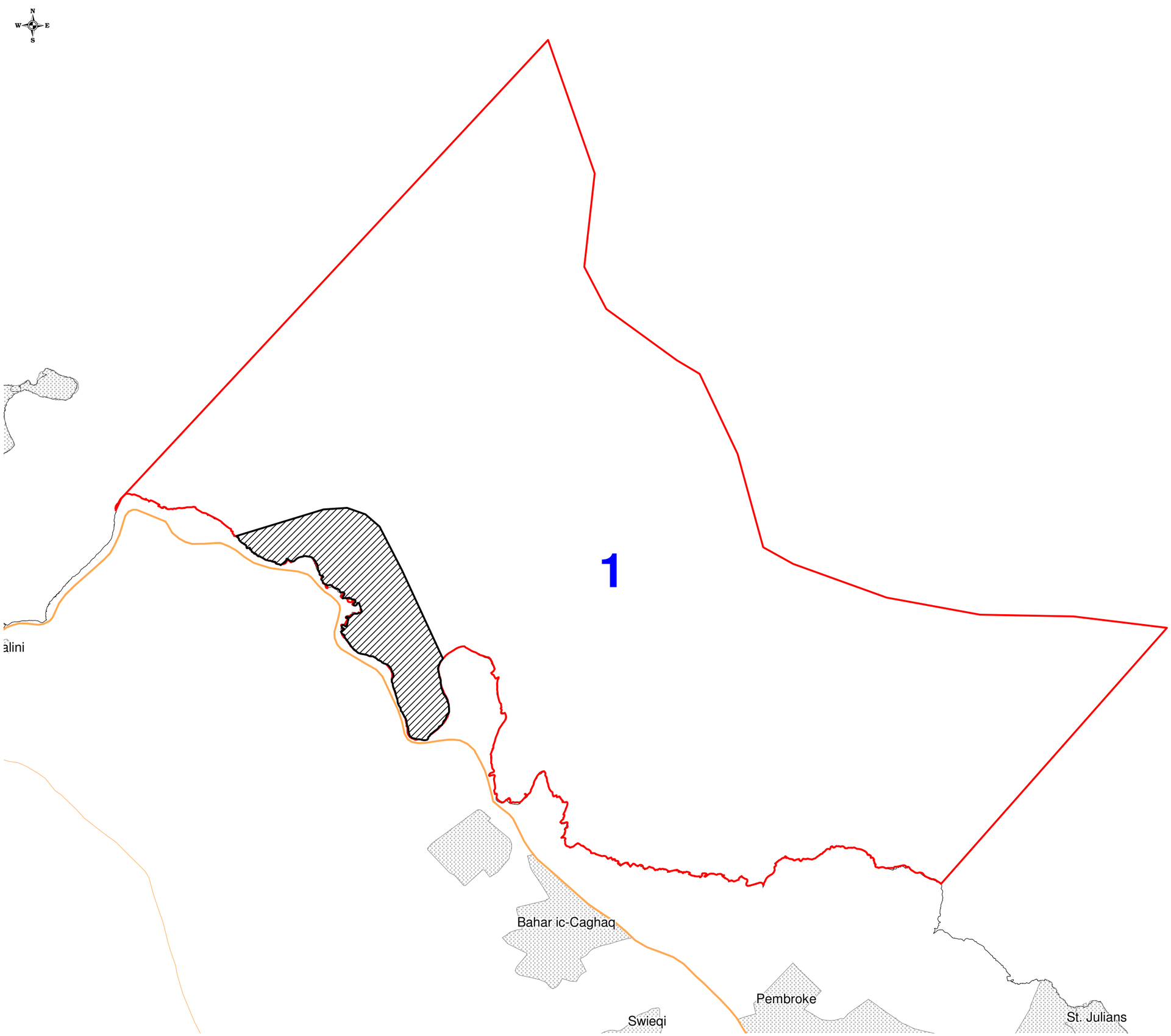

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 1: SHAPE 1C

SCALE AT A3:

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FIGURE 6-1C

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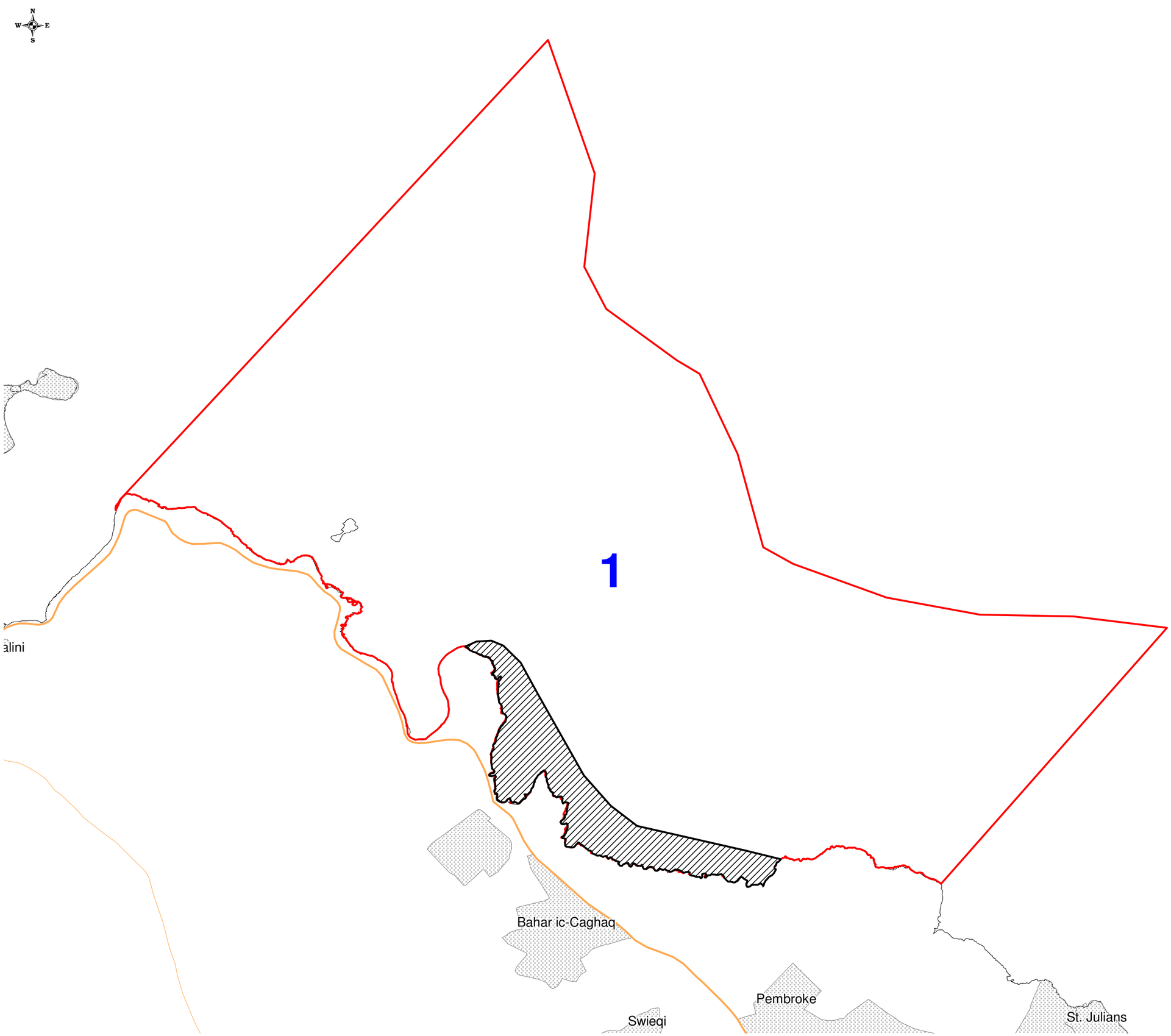

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 1: SHAPE 1D

SCALE AT A3:

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FIGURE NUMBER:

FIGURE 6-1D

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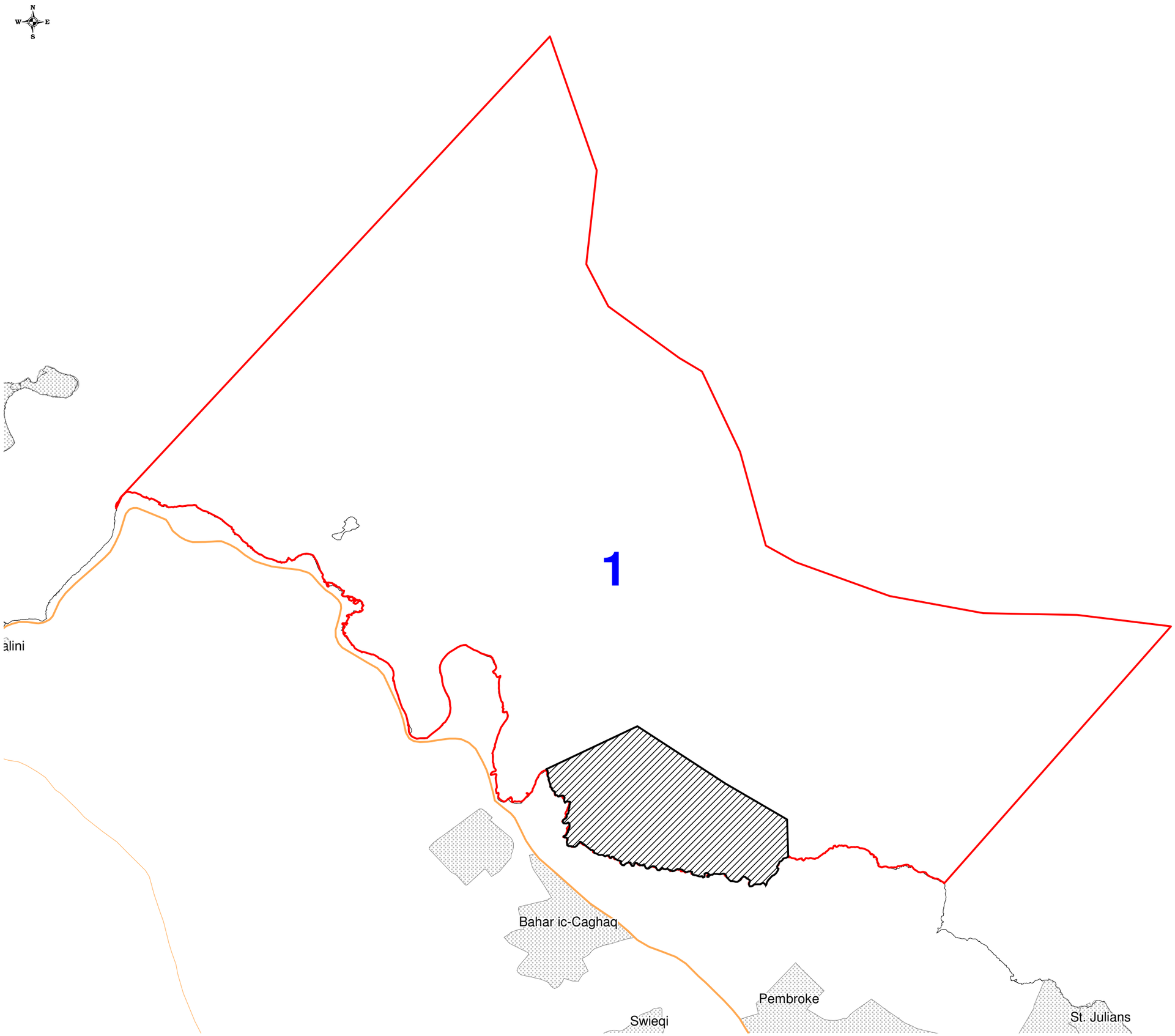

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 1: SHAPE 1E

SCALE AT A3:

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FIGURE NUMBER:

FIGURE 6-1E

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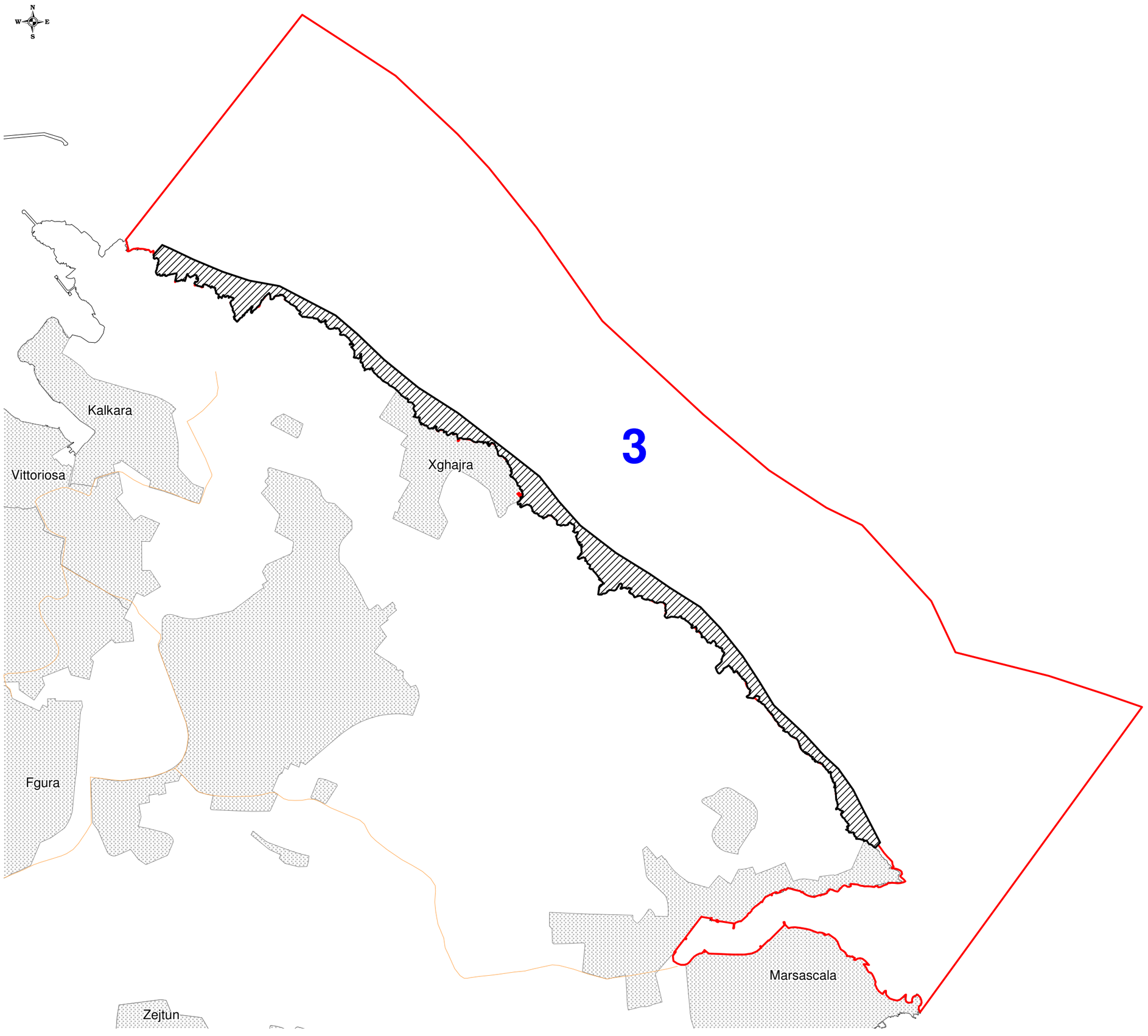

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: SHAPE 3A

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FIGURE NUMBER:

FIGURE 6-2A

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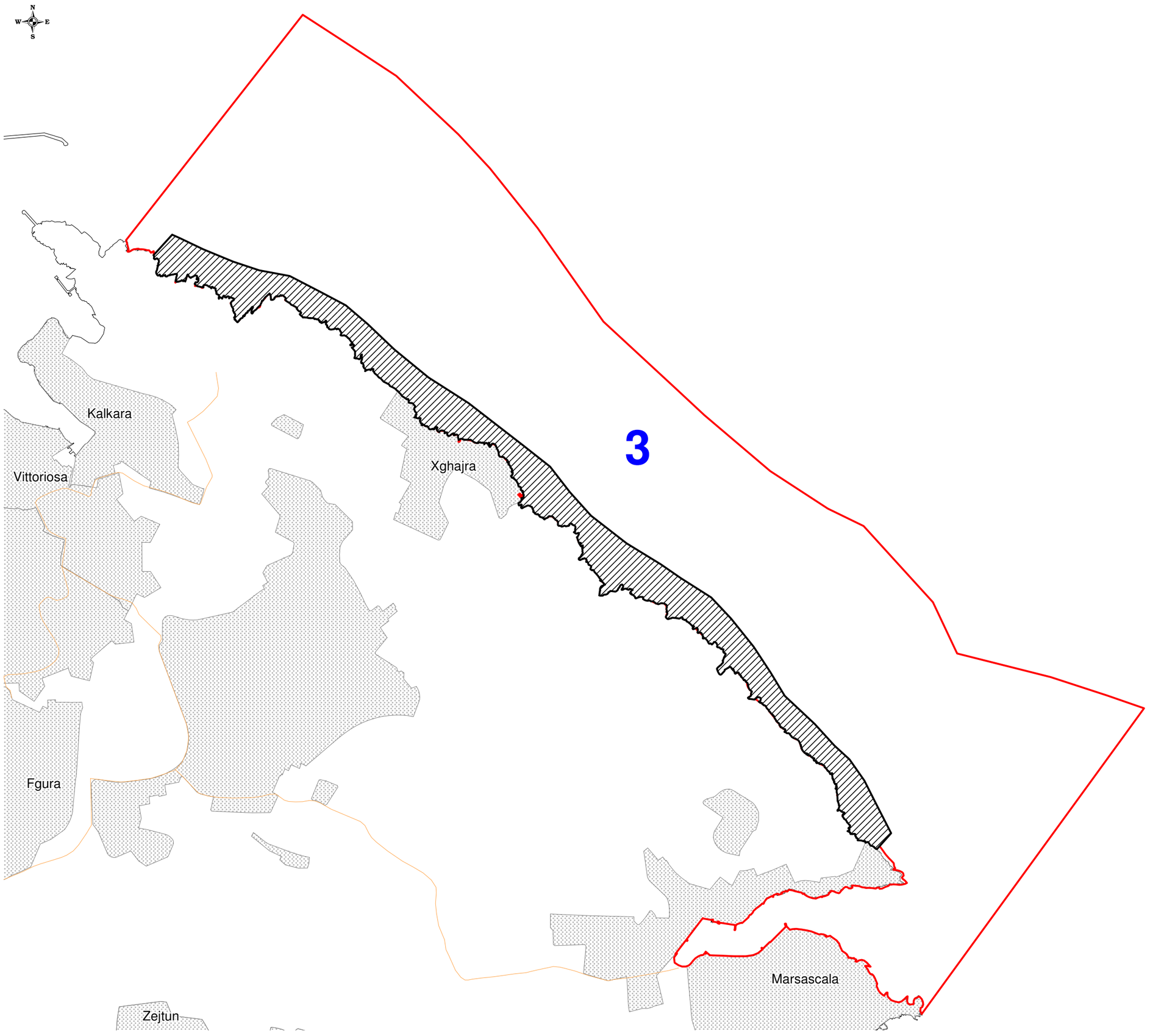

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: SHAPE 3B

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FIGURE NUMBER:

FIGURE 6-2B

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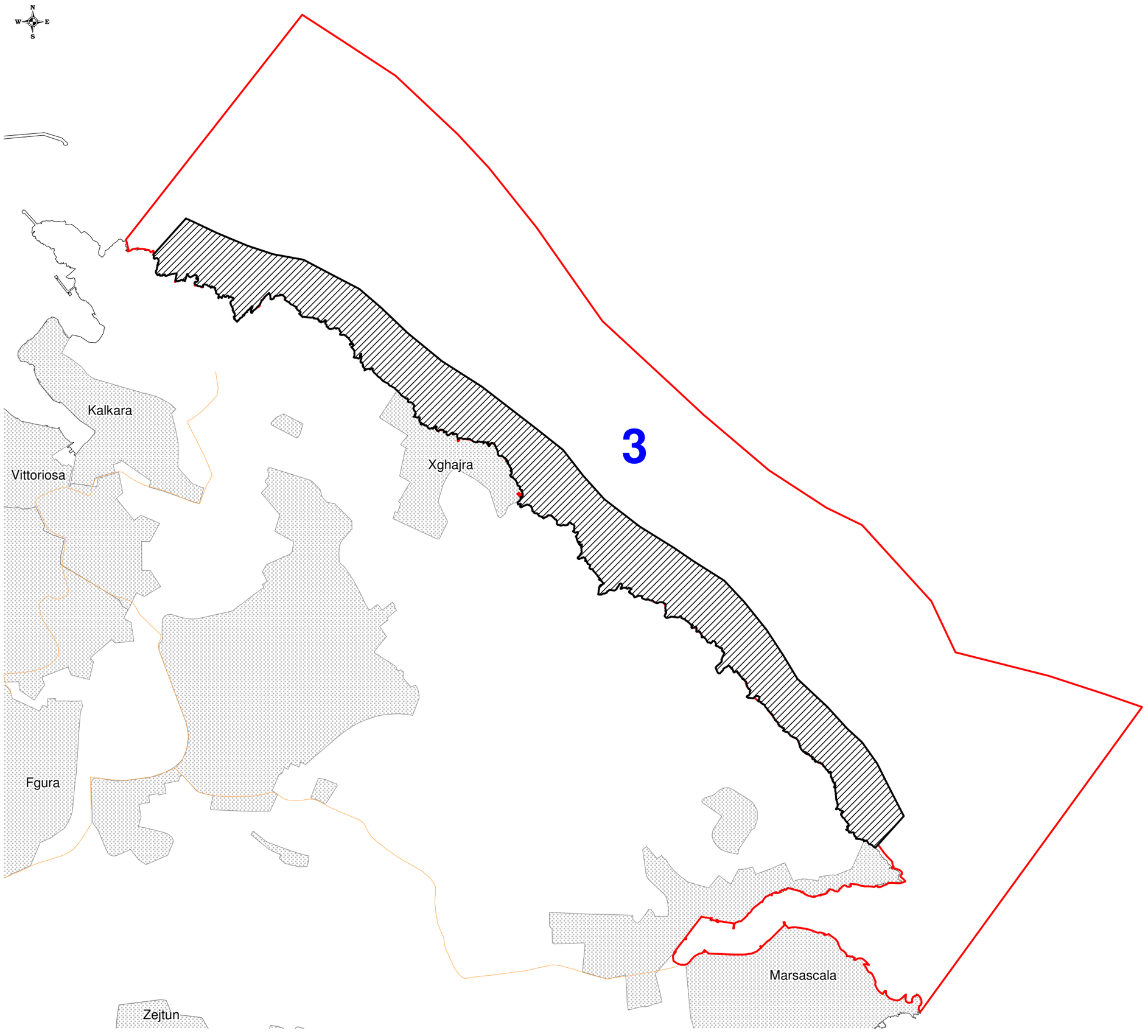

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: SHAPE 3C

SCALE AT A3:

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FIGURE NUMBER:

FIGURE 6-2C

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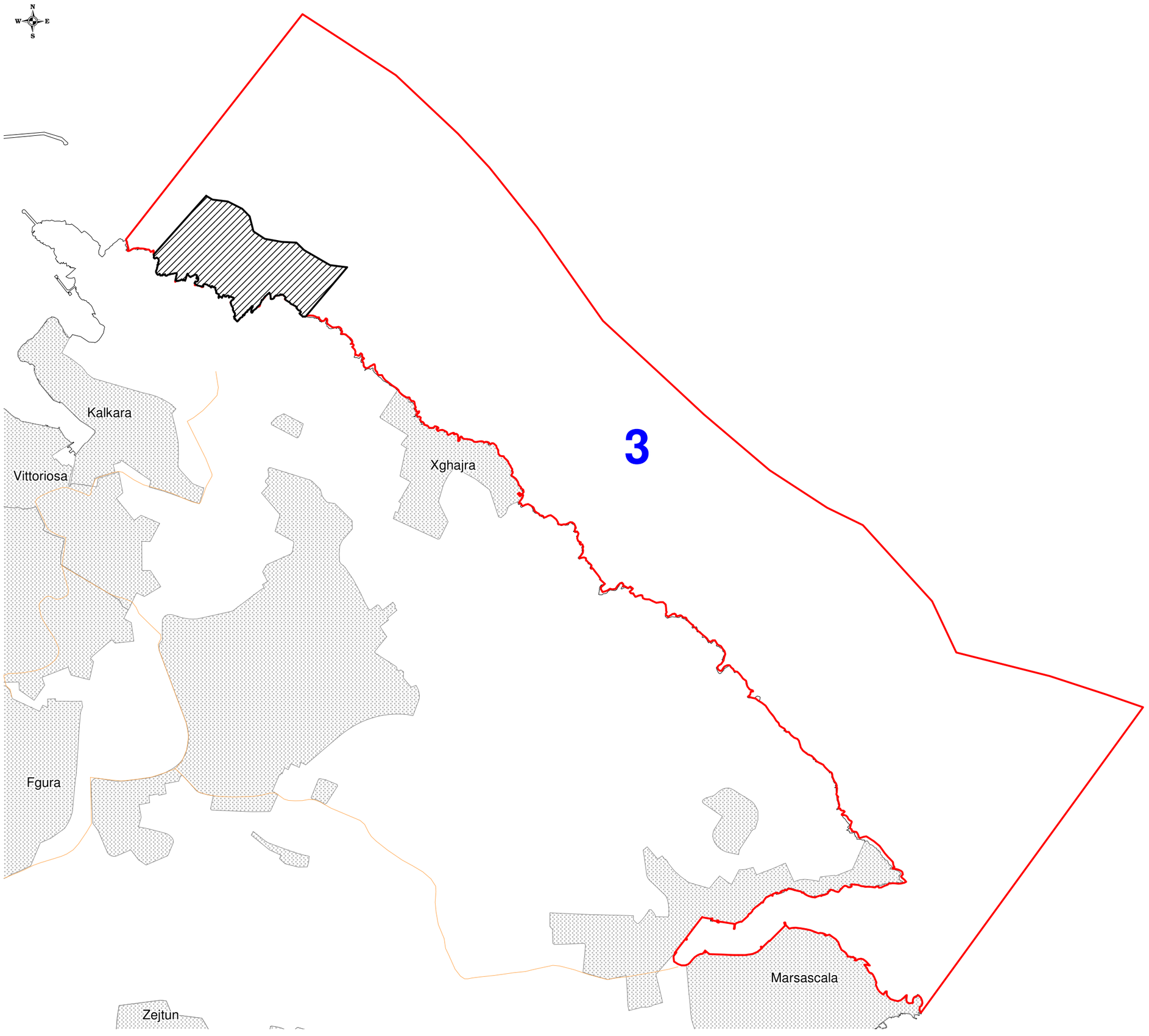

Notes

Search area boundary

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: SHAPE 3D

SCALE AT A3:

1: 20 000

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FIGURE NUMBER:

FIGURE 6-2D

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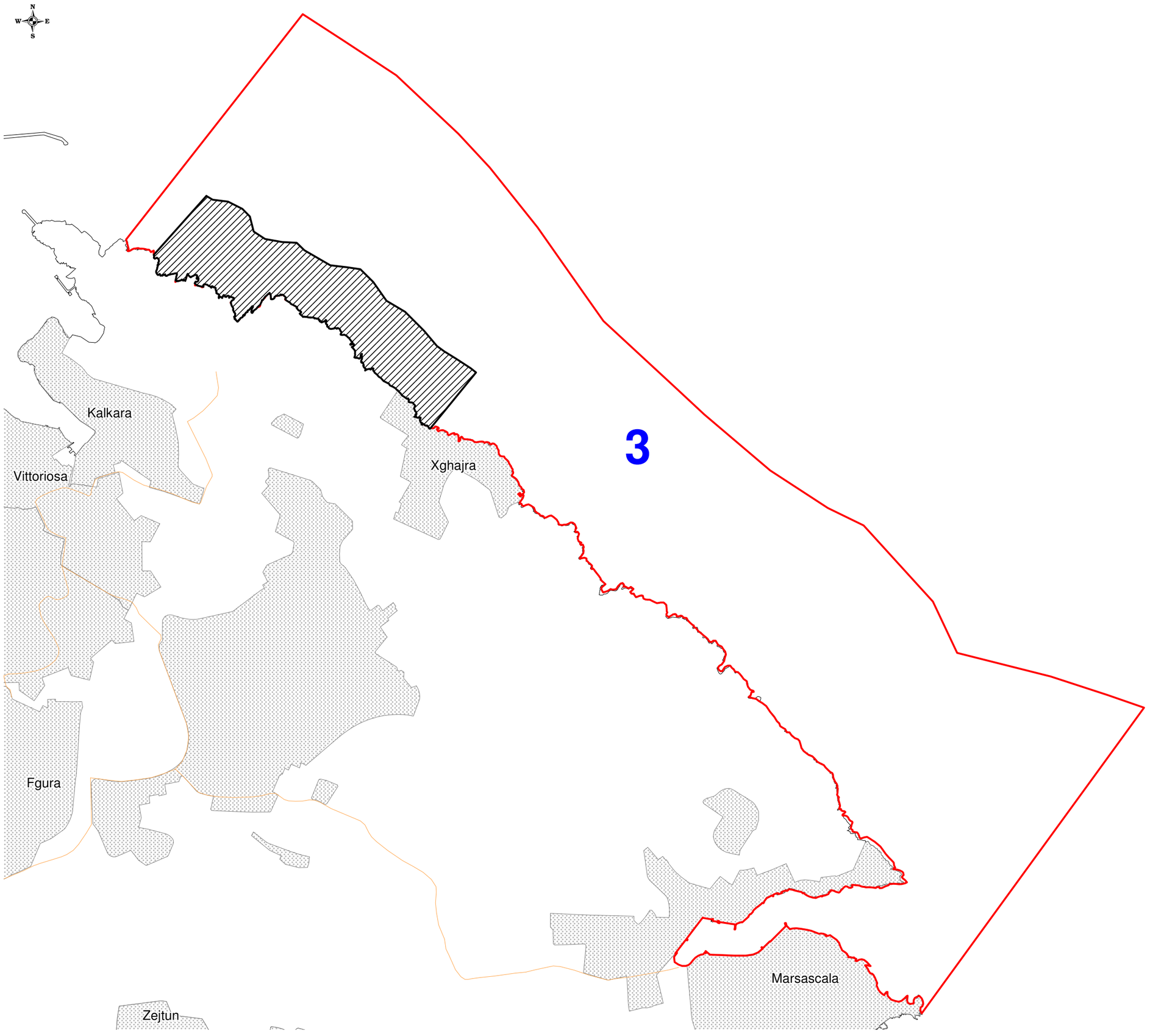

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: SHAPE 3E

SCALE AT A3:

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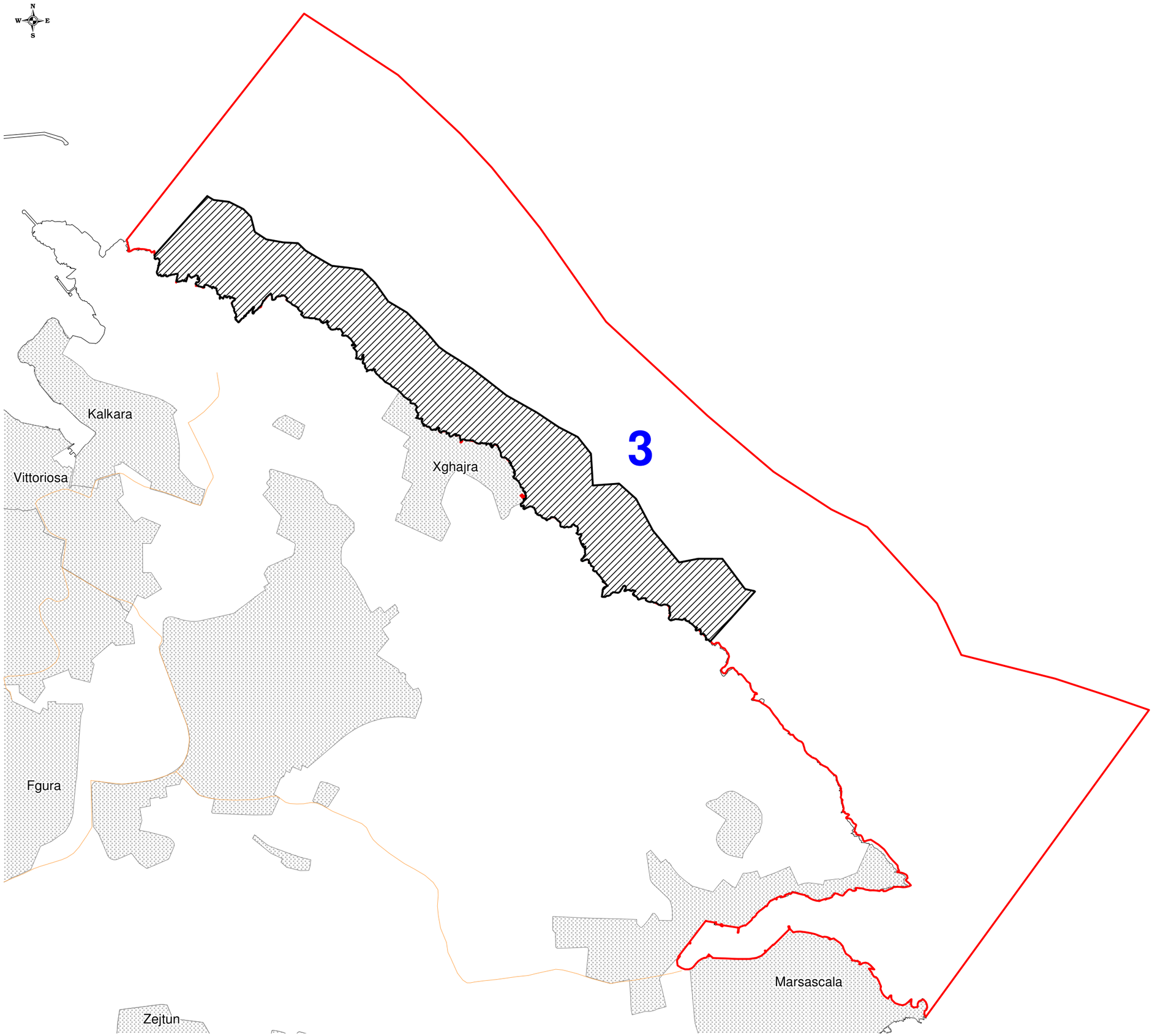

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PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: SHAPE 3F

SCALE AT A3:

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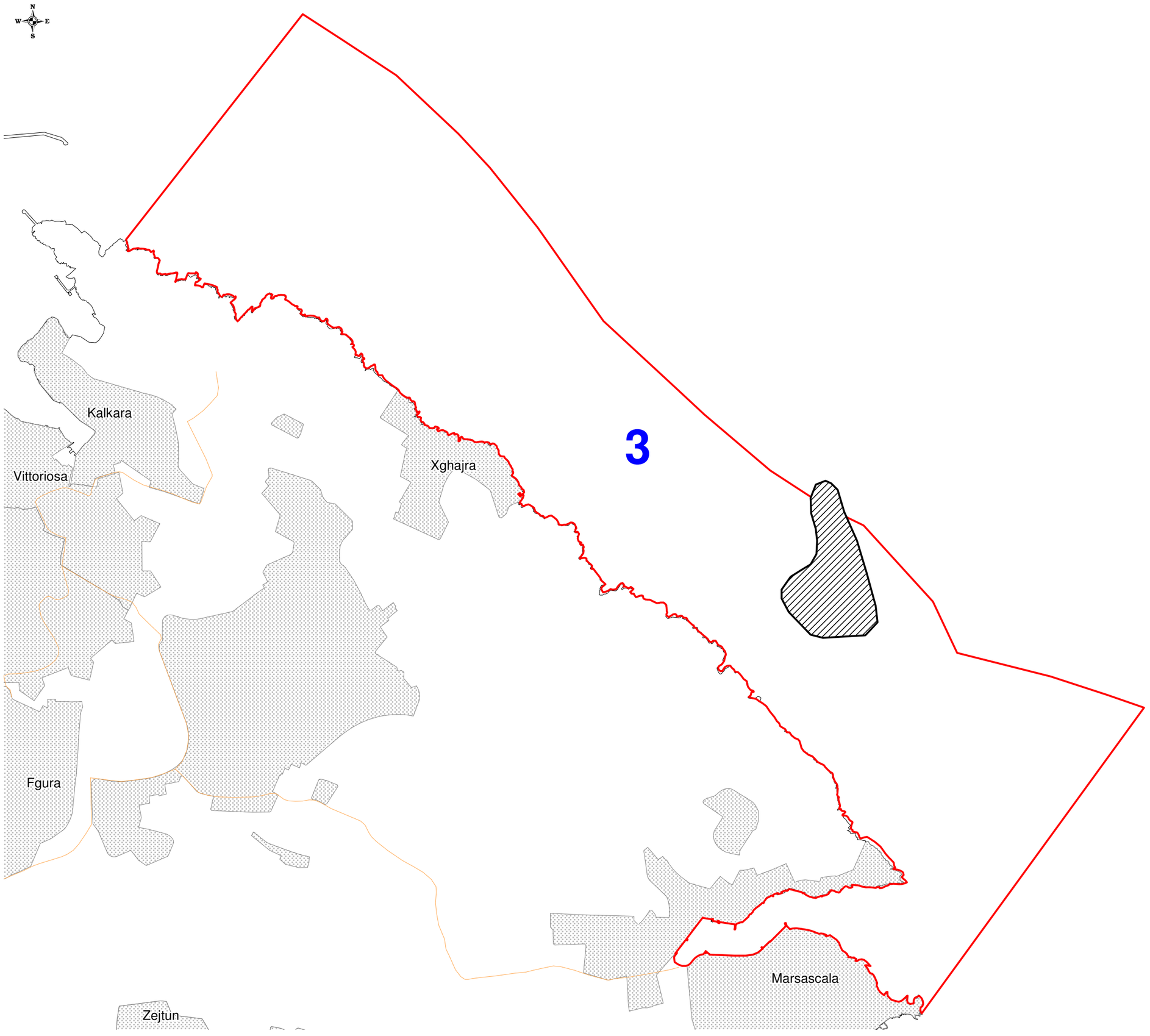

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Search area boundary

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: SHAPE 3G

SCALE AT A3:

1: 20 000

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FIGURE NUMBER:

FIGURE 6-2G

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7 Coastal Process Modelling

Hydrodynamic Model

7.1 A numerical model of the seabed levels around the coast of Malta was created as shown below in Figures 7-1 to 7-3 below. This model was then used as a basis for assessing wind-generated currents.

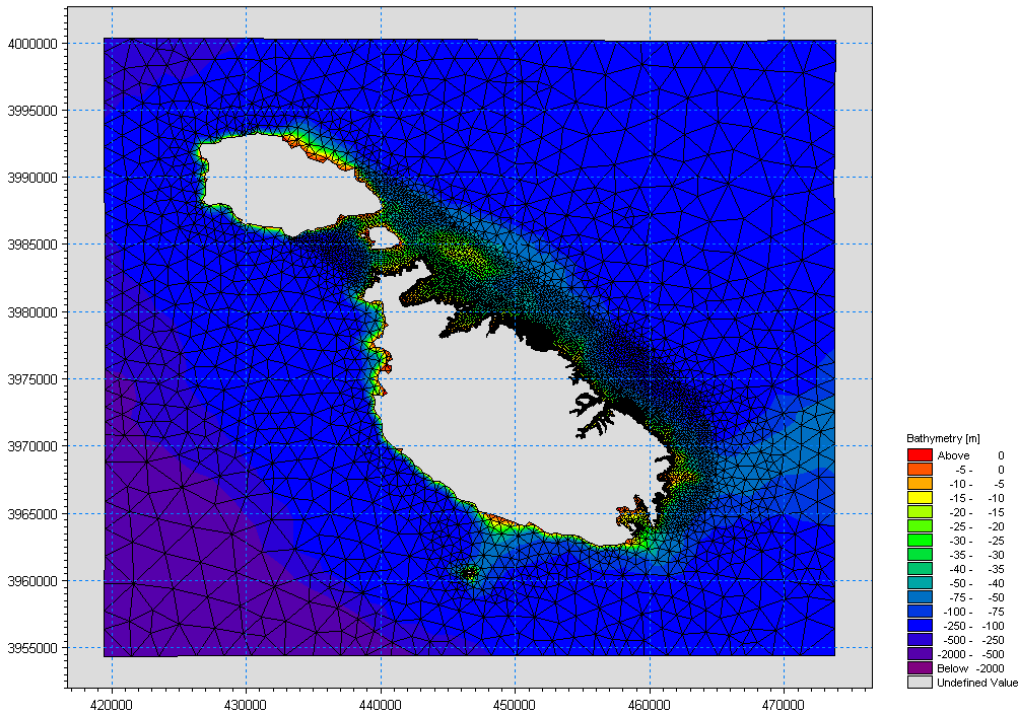

Figure 7-1: Bathymetric contours and unstructured mesh.

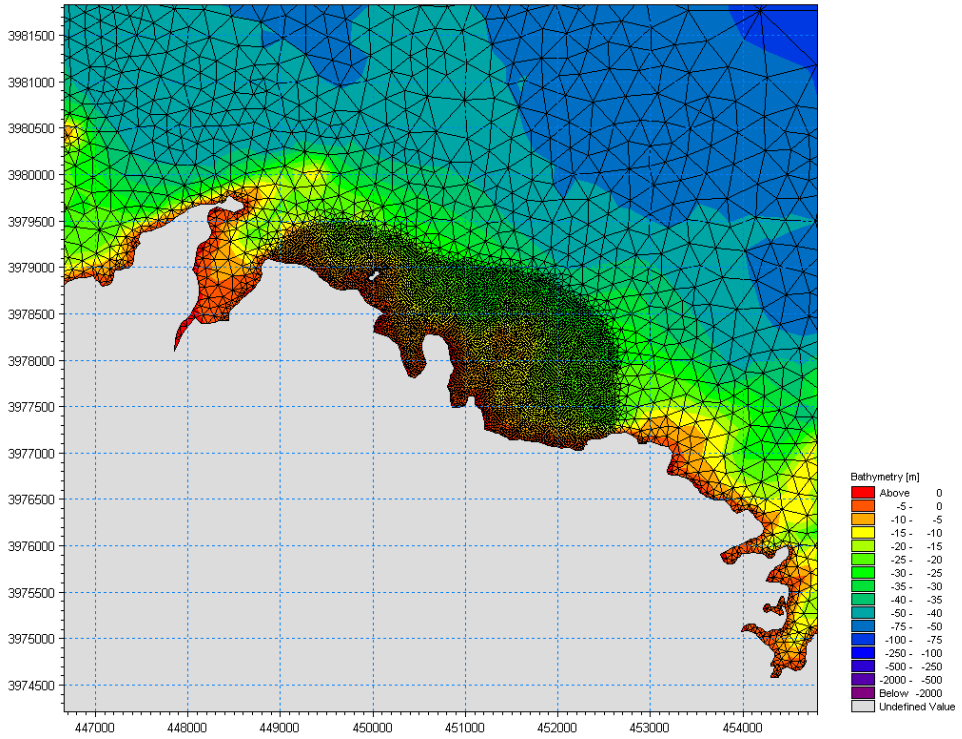

Figure 7-2: Bathymetric contours and refined mesh in Search Area 1.

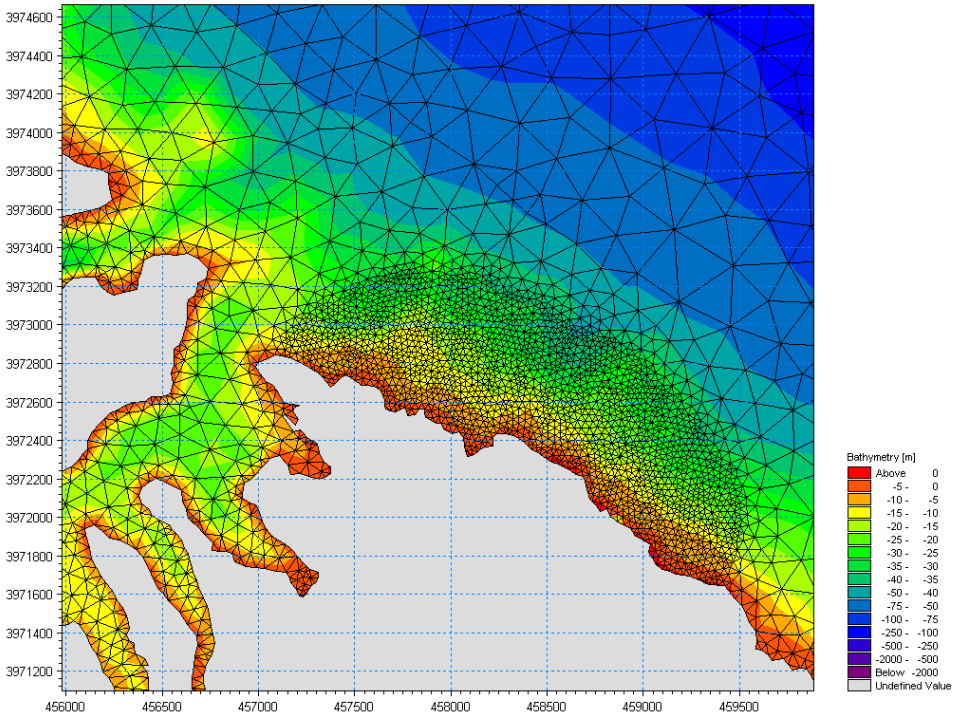

Figure 7-3: Bathymetric contours and refined mesh in Search Area 3.

Wind

7.2 Wind was the primary forcing constituent used to drive the model. Based on an analysis of available wind data, two typical scenarios were modelled:

- A 16knot (8.2m/s) wind blowing from the northwest (300° clockwise from true north) over the entire model domain for 24hrs; and
- A 16knot (8.2m/s) wind blowing from the east (90° clockwise from true north) over the entire model domain for 24hrs.

Design Simulations

7.3 To maximize the efficiency of the model output, six design simulations were devised to include various combinations of wind conditions and partial reclamation options

Table 7-1: Design Simulations.

Simulation ID	Windspeed (m/s)	Wind Direction (° cw true N)	Bathymetry	Duration (hrs)
H01a	8.2	90	Existing	24
H02a	8.2	300	Existing	24
I01a	8.2	90	Partial Reclamation 1B	24
I01a	8.2	300	Partial Reclamation 1B	24
J01a	8.2	90	Partial Reclamations 1C & 3D Combined	24
J01a	8.2	300	Partial Reclamations 1C & 3D Combined	24

Results

7.4 Easterly winds generate coastal circulations that travel northwards along the east coast of Malta in the model, whereas the 300° winds drive currents in a south-easterly direction parallel to the coastline (see Figure 7-4 and Figure 7-5, respectively).

7.5 Comparisons between vector plots for the existing scenario (Figure 7-6, Figure 7-8, Figure 7-10 and Figure 7-12) and partially reclaimed scenarios (Figure 7-7, Figure 7-9, Figure 7-11 and Figure 7-13) indicate that local flow regimes will be significantly affected by the proposed reclamations. However, in the far field (the order of 500m to 1km away from the proposed reclamation sites), the influences are negligible. The primary effect of the reclamations will be to create an obstacle to current paths, accelerating currents on the updrift face and generating recirculating eddies and so-called “dead zones” at the downdrift end, most clearly demonstrated by Figure 7-14.

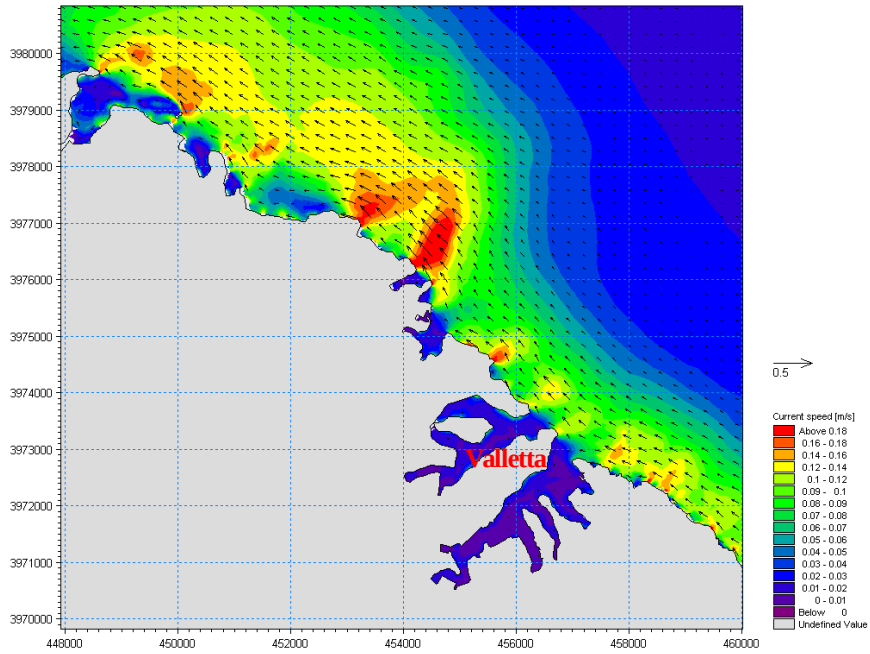

Figure 7-4 Current speed contours and velocity vectors after 24hrs of wind (16knots) from 90°.

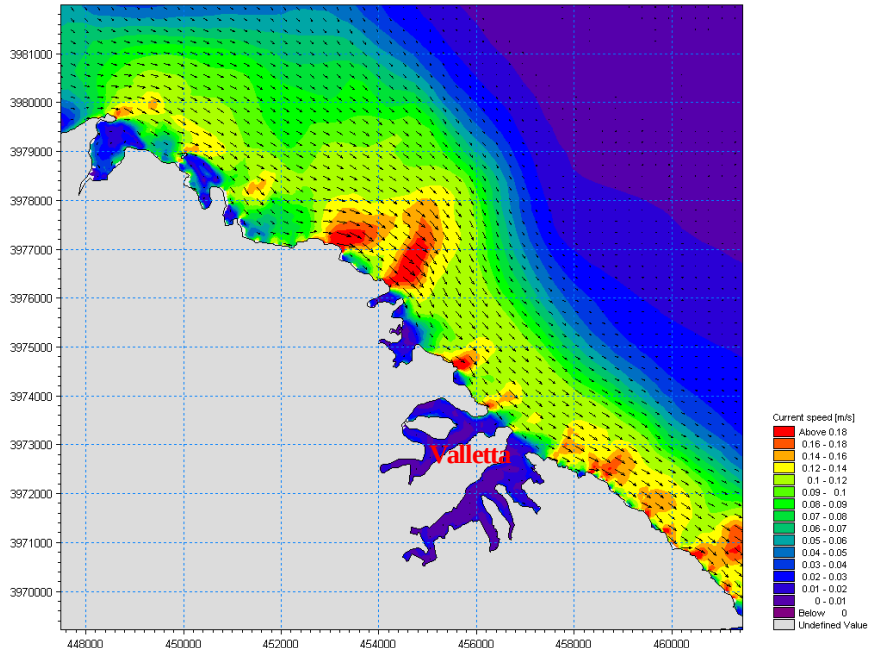

Figure 7-5 Current speed contours and velocity vectors after 24hrs of wind (16knots) from 300°.

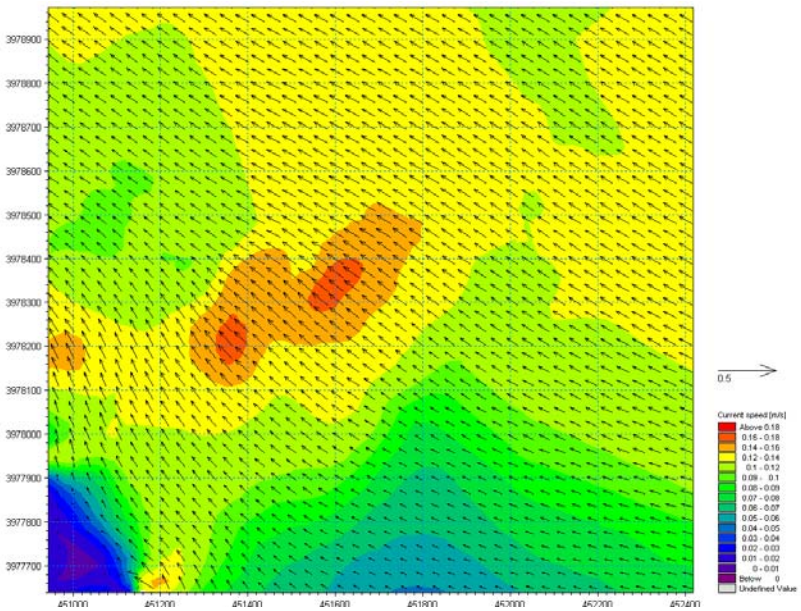

Figure 7-6 Current speed contours and velocity vectors at the undeveloped site of reclamation 1b, for wind direction (wd) = 90°, wind speed (ws) = 16knots and time (t) = 24hrs.

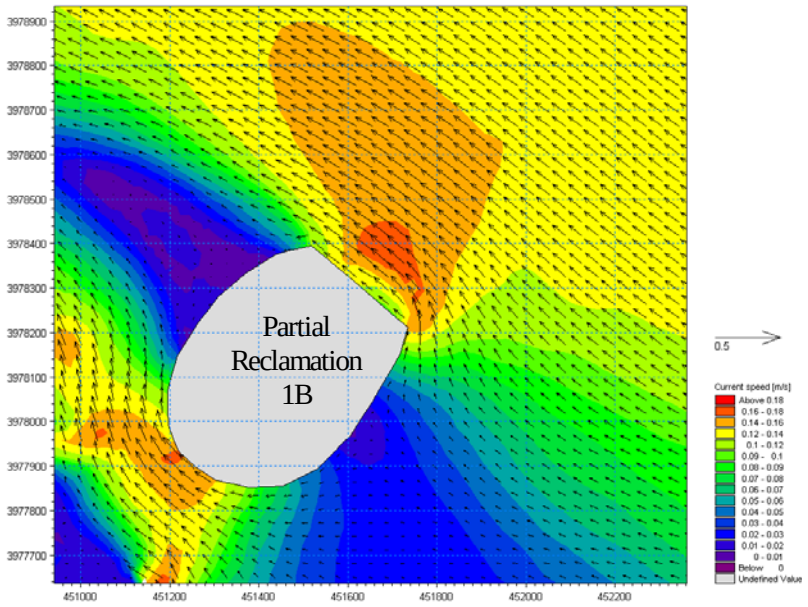

Figure 7-7 Current speed contours and velocity vectors in the vicinity of partial reclamation 1b, for wd = 90°, ws = 16knots and t = 24hrs.

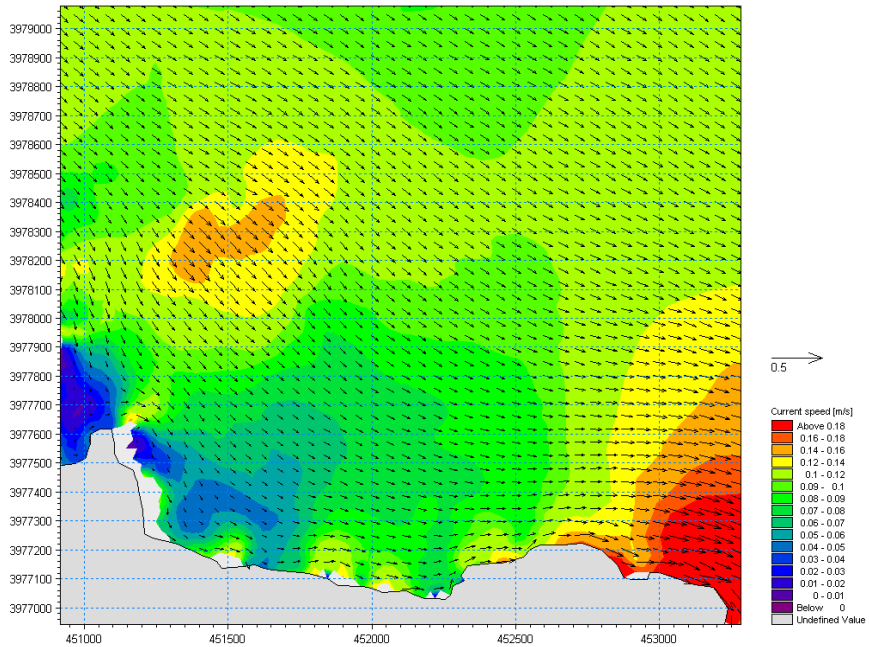

Figure 7-8 Current speed contours and velocity vectors at the undeveloped site of proposed reclamation 1b, for wd = 300°, ws = 16knots and t = 24hrs.

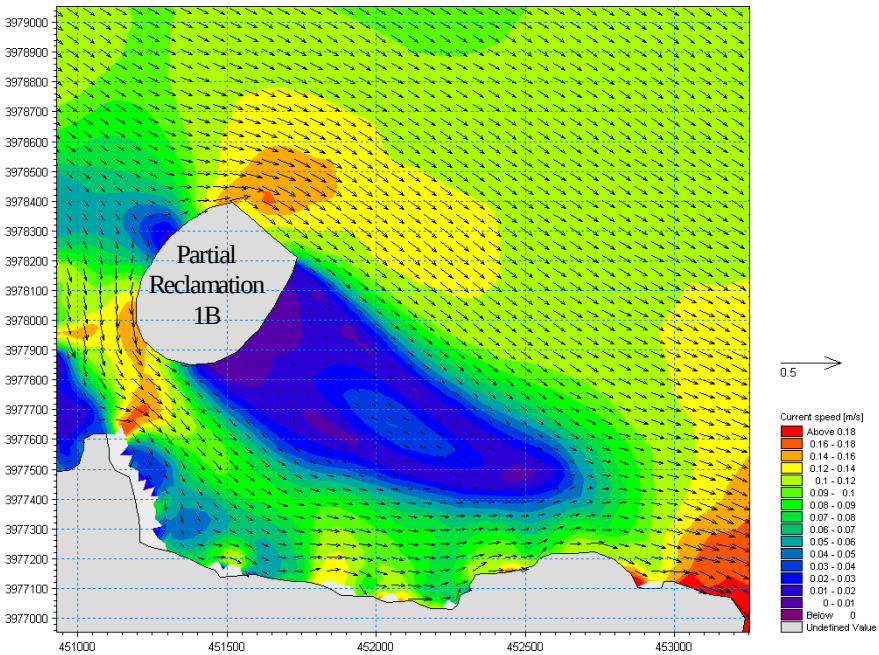

Figure 7-9 Current speed contours and velocity vectors in the vicinity of partial reclamation 1b, for wd = 300°, ws = 16knots and t = 24hrs.

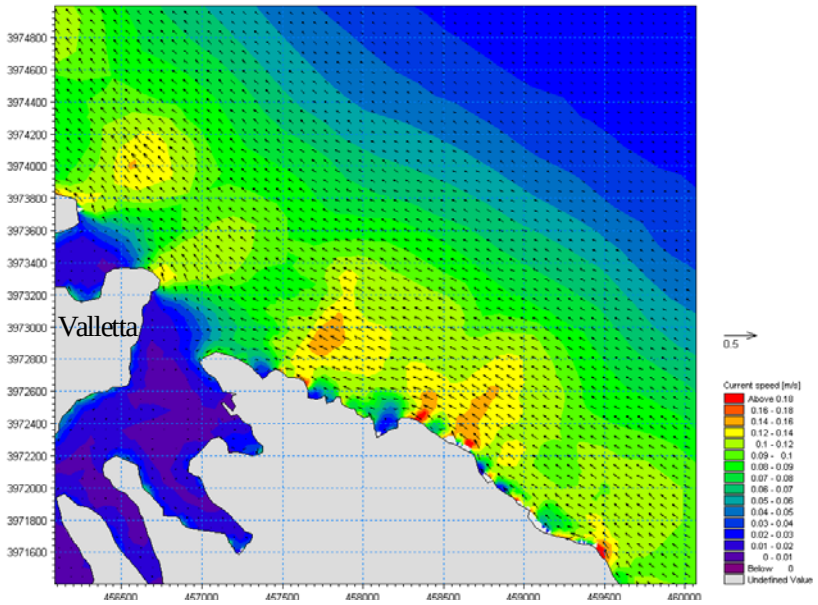

Figure 7-10 Current speed contours and velocity vectors at the undeveloped site of proposed reclamation 3d, for wd = 90°, ws = 16knots and t = 24hrs.

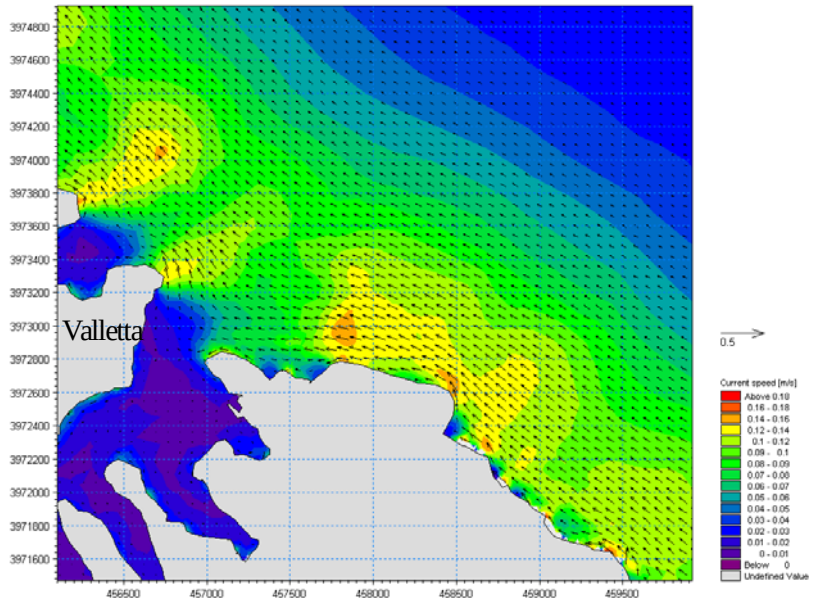

Figure 7-11 Current speed contours and velocity vectors in the vicinity of partial reclamation 3d, for wd = 90°, ws = 16knots and t = 24hrs.

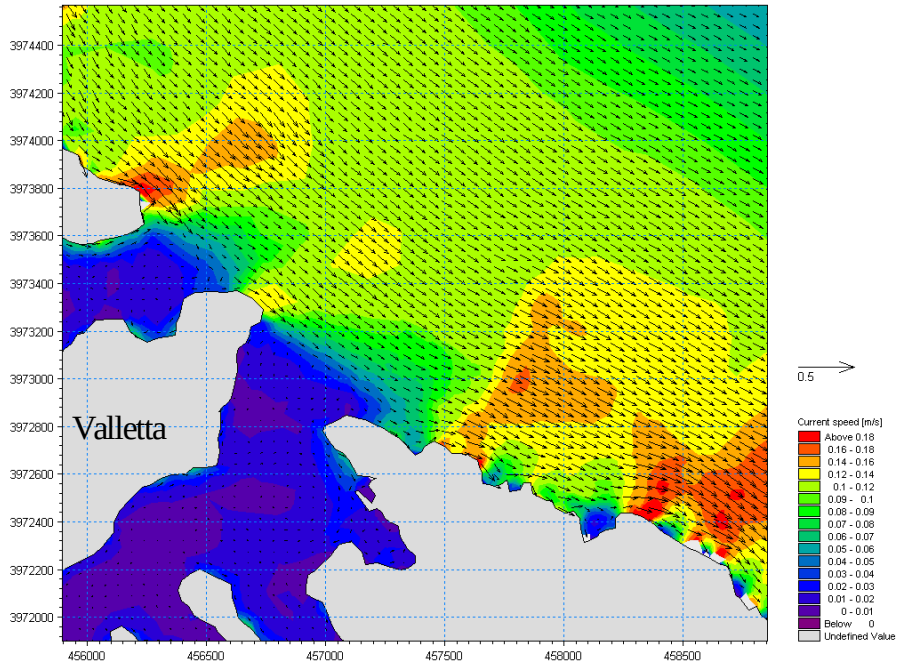

Figure 7-12 Current speed contours and velocity vectors at the undeveloped site of proposed reclamation 3d, for wd = 300°, ws = 16knots and t = 24hrs.

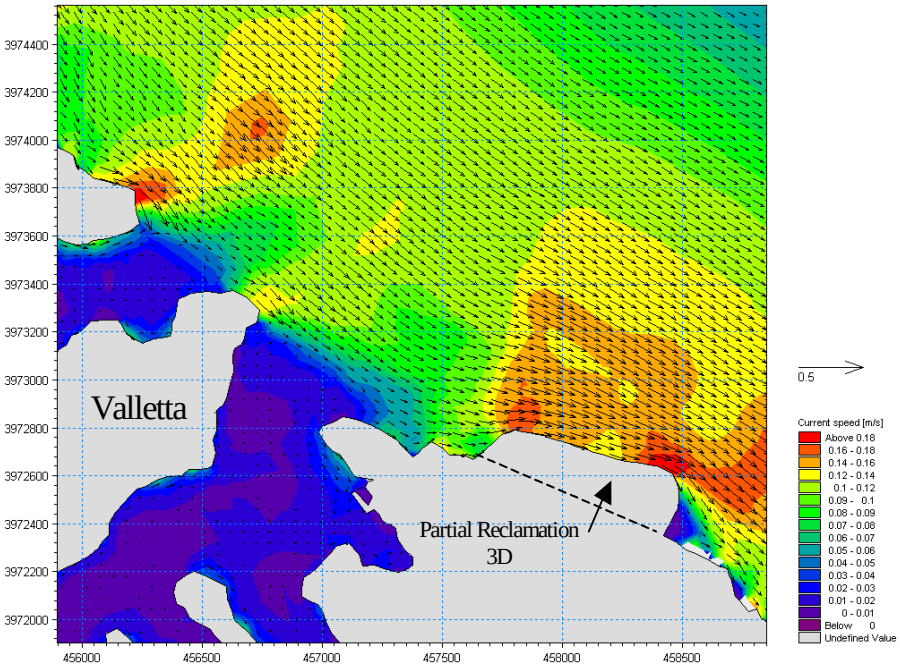

Figure 7-13 Current speed contours and velocity vectors in the vicinity of partial reclamation 3d, for wd = 300°, ws = 16knots and t = 24hrs.

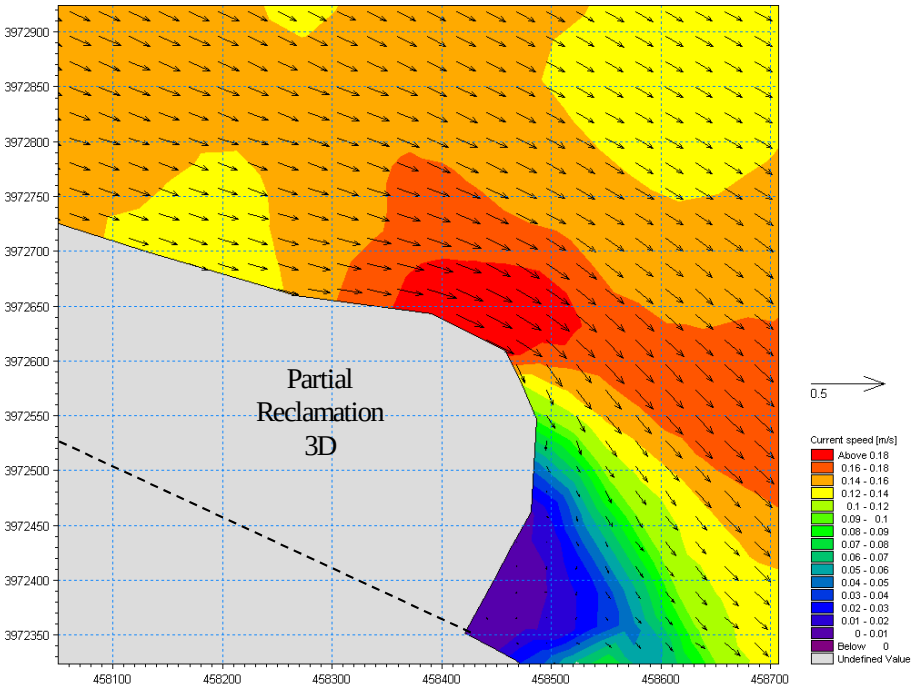

Figure 7-14 Accelerated currents and recirculating eddy adjacent to partial reclamation 3D, for wd = 300°, ws = 16knots and t = 24hrs.

Particle Tracking Model

Reclamation Material Properties

7.6 Limited data was available on the physical properties of the proposed reclamation material. Estimations of the mean and median (D_{50}) particle sizes were made (Table 7-2) based on typical properties of Globergina limestone fill, as described by local ports consultant Mr J A Sciortino.

Table 7-2 Estimated particle diameters for the reclamation material.

Estimated Mean Particle Size, D_{av} (μm)	32
Estimated Median Particle Size, D_{50} (μm)	19

7.7 There was considerable uncertainty regarding a choice of value for the density of the fill particles, due to an absence of data concerning composition and variability. However, this uncertainty has negligible effect on estimations of particle fall velocities in comparison to any potential errors introduced by poor assessments of particle size. Therefore, it was deemed acceptable to consider a range of sensible dry particle densities, ρ_s = 2000kg/m^3, 2200kg/m^3, and 2650kg/m^3 (which is the appropriate value for quartz particles).

Estimation of Fill Disposal Rates

7.8 It is not known exactly how much, or how quickly, reclamation material will be deposited adjacent to the Malta shoreline, as these values will be functions of plant availability, the length of the working face, weather and other factors. Therefore, to provide input to the particle-tracking model, some preliminary estimates of material discharge rates were based simply on a requirement for disposal of 1 million tonnes of construction industry waste per annum.

7.9 If the material were to be deposited at a uniform rate throughout the year, the resulting discharge rate ($\dot{m}$) would be approximately 30kg/s. However, considering the likelihood that a maximum of 12 hours per day will be available for operations and that 25% of the material is composed of large particles (e.g., cobbles and boulders) that sink to the seabed almost immediately, this is increased to 50kg/s. Making the further assumption that only 10% of the remaining material will be directly exposed to currents and dispersive processes, we arrive at an estimate of 5kg/s of fine material being introduced to the water column.

Design Simulations

7.10 A number of particle-tracking simulations were carried out using the available information from each of the six hydrodynamic simulations described in Table 7-1.

7.11 Figure 7-15 and Figure 7-16 show the suspended sediment plumes generated after 24hrs in an easterly wind with high (50kg/s), medium (30kg/s) and low (5kg/s) discharge rates from a point on the working face of the partial reclamation. Note that the outermost extent and travel distance of the plume after this period of time is not very sensitive to loading rate – only concentrations within the plume are significantly affected. The majority of the released fill material accumulates in areas of low velocity, where settling reduces mobility.

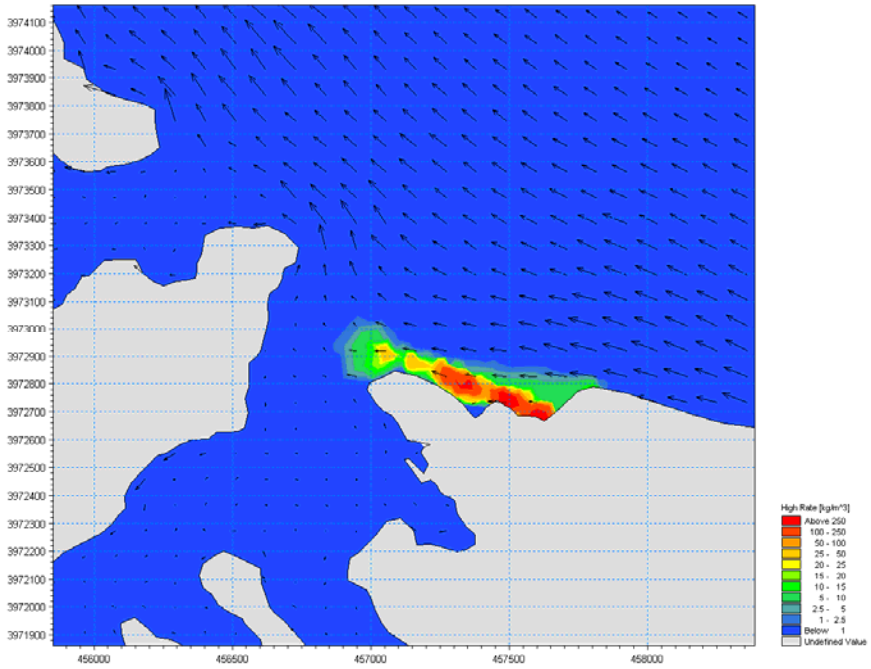

Figure 7-15 Particle plume near partial reclamation 3d, for ws = 16knots, wd = 90°, t = 24hrs and mass discharge rate ($\dot{m}$) = 50kg/s.

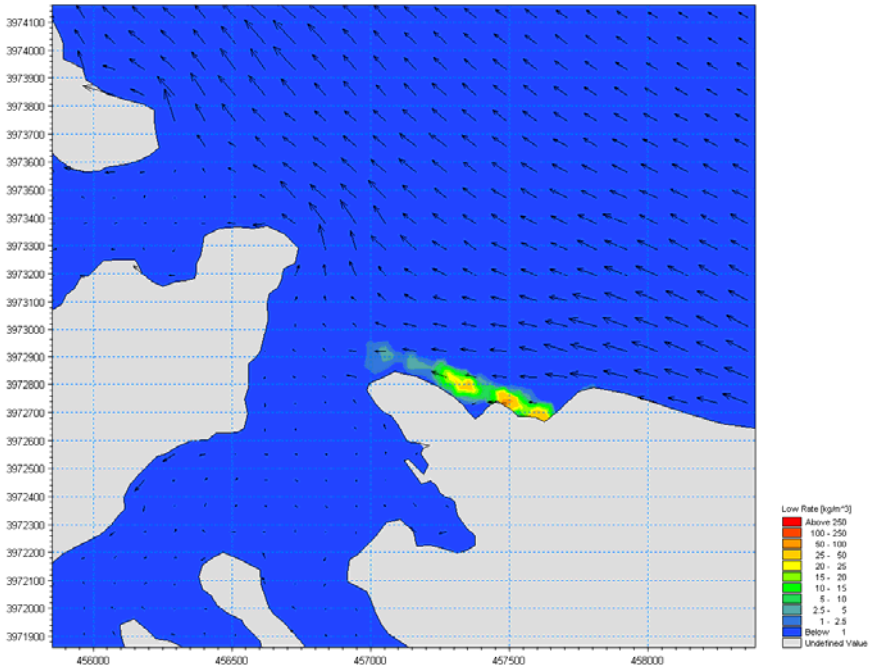

Figure 7-16 Particle plume near partial reclamation 3d, for ws = 16knots, wd = 90°, t = 24hrs and $\dot{m}$ = 5kg/s.

7.12 For the same partial reclamation (3d), Figure 7-17 to Figure 7-20 show the evolution of the plume corresponding to the high estimate of fill discharge (50kg/s), with currents driven by the north-westerly wind. The snapshots show the extent of suspended material disseminating from the partial reclamation at times corresponding to 3hrs, 6hrs, 12hrs and 24hrs after the discharge begins and the wind begins to blow. The final plume length is approximately 2km long but would likely increase if the wind event were to continue beyond 24hrs, or if a less conservative estimate for particle settling velocities was chosen.

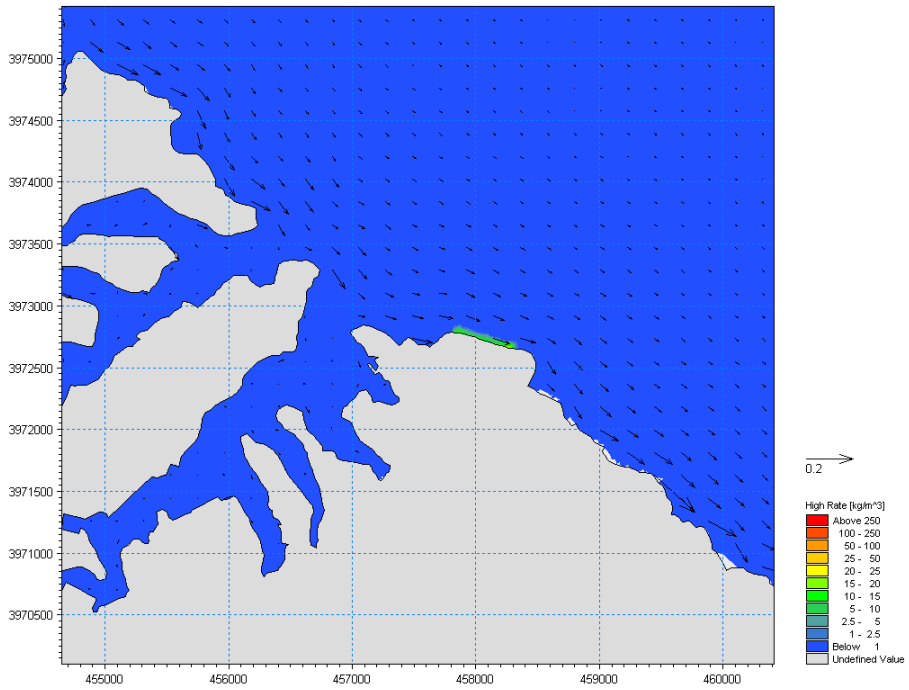

Figure 7-17 Particle plume near partial reclamation 3d, for ws = 16knots, wd = 300°, t = 3hrs and $\dot{m}$ = 50kg/s.

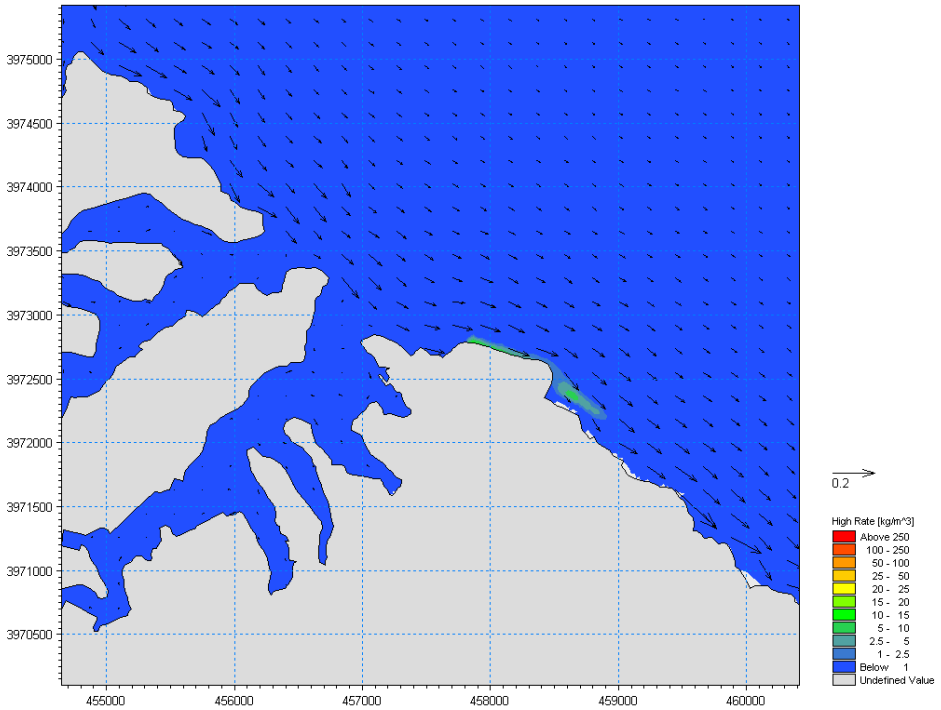

Figure 7-18 Particle plume near partial reclamation 3d, for ws = 16knots, wd = 300°, t = 6hrs and $\dot{m}$ = 50kg/s.

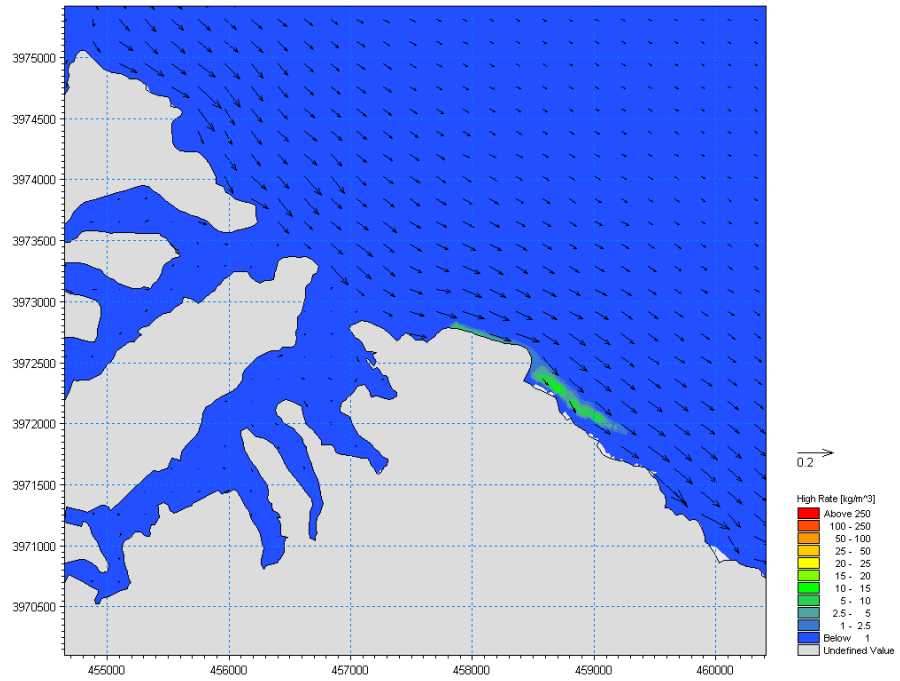

Figure 7-19 Particle plume near partial reclamation 3d, for ws = 16knots, wd = 300°, t = 12hrs and $\dot{m}$ = 50kg/s.

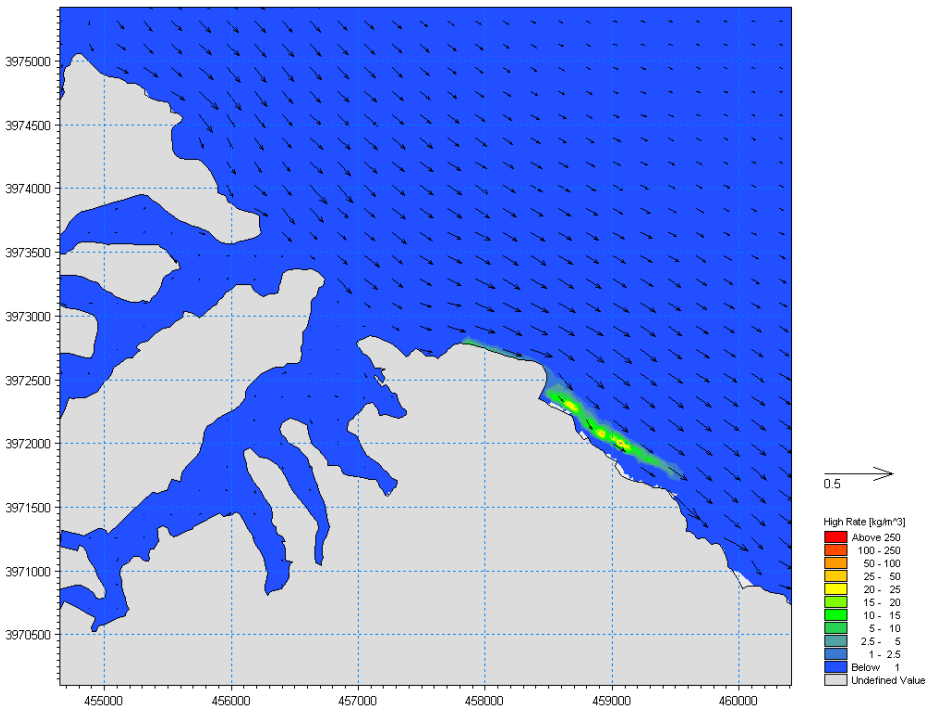

Figure 7-20 Particle plume near partial reclamation 3d, for ws = 16knots, wd = 300°, t = 24hrs and $\dot{m}$ = 50kg/s.

7.13 Figure **7-21** and Figure **7-22** show the plumes after 24hrs arising from dispersal of fill material from the working face of partial reclamation 1b (for both northerly and southerly currents). For these scenarios, the final total suspended sediment concentrations are noticeably smaller than at the other partial reclamation sites, which is primarily explained by two factors:

- The fill is being introduced to considerably deeper waters, so there is greater volume of water available to dilute the material;
- The island reclamation is directly in the path of the strongest currents, which are just offshore. This, coupled with the accelerations of fluid (and associated turbulent diffusion) induced by the presence of the reclamation, rapidly transports particles away from the reclamation to diluting waters.

7.14 An interesting feature of the plume shown in **Figure** 7-22 is the formation of a secondary filament, running parallel to the primary cloud of suspended sediment. This is a result of entrainment and rolling up of suspended material in a re-circulating wake eddy downdrift of the island. Such features are evidence of the complicated nature of sediment dispersal in conjunction with land reclamation, supporting the suggestion that detailed predictive modelling and risk assessments are essential tasks to be completed prior to the commencement of any such works.

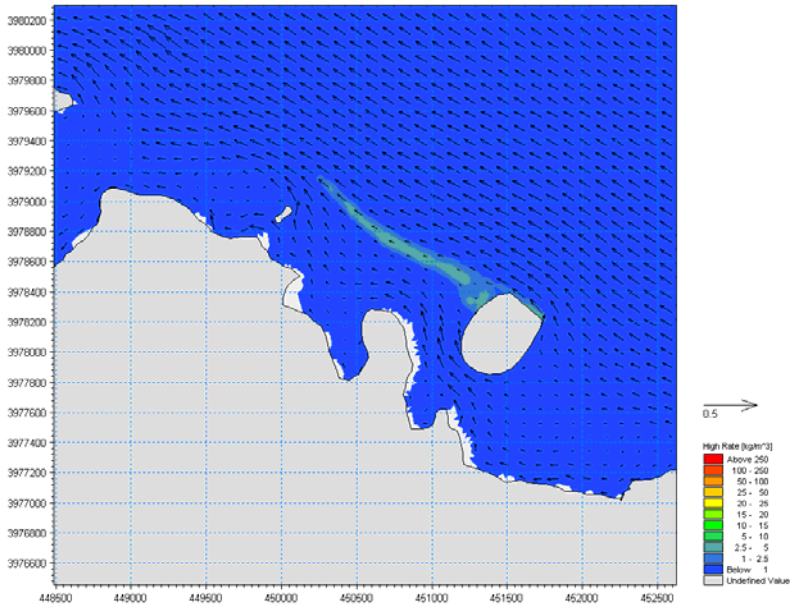

Figure 7-21 Particle plume near partial reclamation 1b, for ws = 16knots, wd = 90°, t = 24hrs and $\dot{m}$ = 50kg/s.

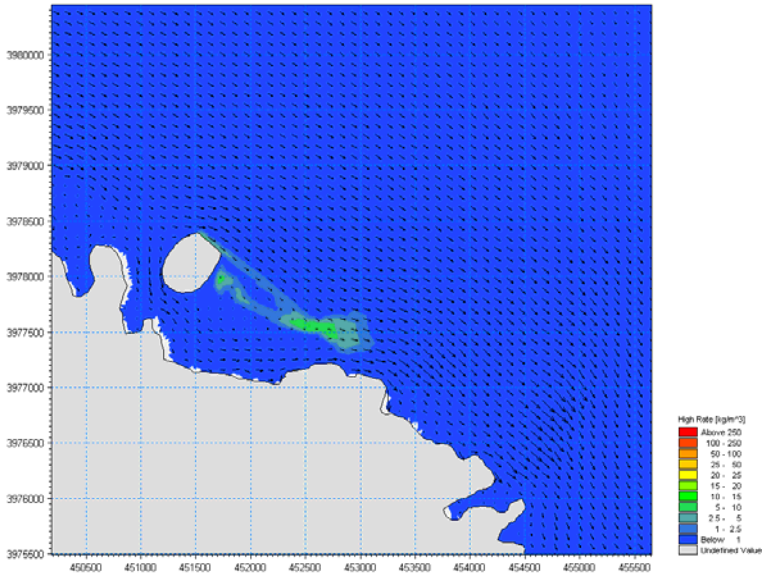

Figure 7-22 Particle plume near partial reclamation 1b, for ws = 16knots, wd = 300°, t = 24hrs and $\dot{m}$ = 50kg/s.

Conclusions

7.15 The results of the hydrodynamic modelling reveal that typical flow regimes on the Malta coast will be locally (i.e., within ~ 500m of the reclamation) disturbed by proposed reclamation options using construction industry waste. The predicted effects are as follows:

- Current speeds
  - Local velocities are increased by acceleration of coastal waters around the proposed reclamations.
  - Stagnant zones develop updrift and downdrift of the proposed developments.
- Current directions
  - Circulation patterns and natural flow routes are altered, as currents are forced around the reclamation landmasses.
  - Turbulent eddy circulation zones develop, driven by flow separation at the edge of the proposed reclamations.

7.16 For a typical 24-hour wind event, total suspended solids concentrations (TSS) are likely to exceed guideline standards over distances of up to 2km from the partial reclamation sites, if reclamation material is deposited directly into adjacent coastal waters. However, the extent of plumes will generally increase if one or more of the following conditions are met:

- Longer wind event duration
  - Extreme wind events are not unprecedented at Malta. The Mellieha Bay records show a number of instances of easterly or northwesterly wind events with speeds >16knots for 3 days or more in the last two years. Although reclamation operations are likely to be suspended under such conditions, events like these would undoubtedly result in the transport of reclamation material further afield.
- Reduced settling velocities
  - The distance travelled by suspended sediment particles is highly sensitive to the rate at which they are deposited on the bed. If the fill material properties differ from those assumed in this report, significantly different estimates of fall velocities may result. This uncertainty coupled with any flocculation or hindering processes not considered here, might result in suspended sediment plumes that remain in the water column for longer periods.
- Increased dispersion coefficients
  - In this study, the rate at which particles are dispersed (characterised by a dispersion coefficient) was assumed to have a linear relationship to the eddy viscosity of the transporting fluid. However, in reality the dispersion coefficient is influenced by a variety of factors, including the size of the

plume, the concentration of suspended solids, the bathymetry and the presence of any vegetation on the bed. Furthermore, observed values in coastal waters vary by orders of magnitude from location to location. As a result, the dispersion coefficient should be viewed as a calibration parameter, which can only be more accurately determined through a dye/drogue study.

- Persistence of stronger currents
    - Current speeds may temporarily exceed the typical values considered in this report, either due to the combined local effects of thermoclinic, tidal and baroclinic forcings, or simply because wind speeds are higher than normal.
- Increased loading rates
    - There is considerable uncertainty regarding the initial rate at which reclamation material would be dispersed into to the sea. This depends on a whole host of factors (including particle size distributions, active and passive plume behaviour, particle cohesion, induced turbulence and ambient stratification), which can only receive cursory treatment at this early stage.

8 Construction Principles for Land Reclamation

Introduction

8.1 Technical aspects related to the construction of land reclamation have been assessed in an outline form in the Project Identification Report (2005). This chapter extends this work, adding further detail. In particular it considers alternative approaches and set out the principles which should apply for:

- Edge protection (breakwaters);
- Land reclamation using bulk fill;
- Construction issues; and
- Construction sequencing.

Edge Protection

Need for Edge Protection

8.2 Any large reclamation constructed in the waters around Malta would need to be protected from erosion by the action of waves and tides. If this was not done then the reclamation would be severely eroded or destroyed over time. This would be the case if the reclamation were to be constructed of good quality construction materials. However, in the case of the construction of a reclamation from the loose, powdery friable material that comprises the bulk of the waste stream the need for edge protection is even more essential.

8.3 In Chapter 7, Coastal Process Modelling, the results of modelling of dispersal of sediment are presented. This shows what would be the fate of unprotected loose material; it would be transported considerable distances by tidal or wave driven currents and could be deposited in many locations where it might potentially harm the local ecology. It is likely that it would form an unsightly surface slick of whitish powder. Therefore a protective structure is required.

Edge Protection Structure

Technical Limitations and Costs

8.3.1 A review of reclamation schemes and breakwaters worldwide has been carried out to assess the feasibility of carrying out reclamation in deep water. While it is quite possible to create reclamations in deep water simply through placement of material via a pipeline or by vessel, it is the construction of the ‘edge protection’ which is one of the key limiting factors,. There are a number of different types of edge structure that may be used to protect the reclamation fill and, as discussed in the following section; the cost of construction of all

these structures will increase exponentially with depth.

8.4 There have been only a handful of breakwaters built in water depths greater than 20m because of the considerable technical challenges and prohibitive costs involved. Generally, construction of reclamation and breakwaters in depths greater than 20m has been carried out to support very high value, key infrastructure requirements such as major ports or airports rather than for general development purposes.

8.5 Although a breakwater has been constructed in 63m water depth at Kamaishi Port in Japan, it is for tsunami protection and hence the extreme cost of breakwater construction was justified by the protection provided to infrastructure and safeguarding of life. Expansion of the Port of Singapore involved construction in deep water for vessel drafts of 16m; this development is unique in the sense that it is part of the world's busiest port; since Singapore is lacking in land and natural resources, and the port plays a crucial role in the economy of the country.

8.6 Scott Wilson has current experience of two of the largest breakwater projects planned for anywhere in the world. The breakwater for the Costa Azul LNG terminal in Mexico which Scott Wilson designed and is now under construction has an approximate cost per metre of €125,000.. The breakwater is a precast concrete caisson structure filled with sand installed in a water depth of approximately 20m. The caissons are 70m long, 38m wide and 25.5m tall. The wave climate at the site is more severe than Malta. The breakwater for Colombo Harbour in Sri Lanka, designed by Scott Wilson, has an estimated cost per metre of €35,000. Most of the materials are locally sourced. Since costs of labour and materials in Sri Lanka are relatively low, an equivalent structure constructed in Malta would be more expensive. This breakwater is in a water depth of 17 – 20m.

8.7 Following careful consideration of these issues, we consider it highly unlikely that there will be a feasible, economic and technical solution to construction of a reclamation in a water depth greater than 20m. This obviously significantly limits the possible location and extent of marine reclamation within Areas 1 and 3.

8.8 The Project Identification Report suggests an edge protection structure constructed in 20 – 25m water depth has a cost of approximately €17,500 per metre. By comparison with other schemes internationally, the figure of €17,500 would appear to be very low. The cost estimates generated in Chapter 12 equate to between €34,900 and €104,800 per metre, depending on depth.

Structure Types

8.9 A review of coastal engineering works in Malta has been carried out to gather information about the types of structure and construction techniques that have been used successfully locally.

8.10 Over the last forty years, coastal engineering works in Malta have covered all aspects of marine construction, starting from the construction of the ferry terminal in Gozo in 1970 through to the construction of the China Dock, the main sewage outfall, the Freeport container terminal, and more recently, the hardstanding at Il-Ponta tal-Qretjen, Marsaxlokk,

the cruise liner terminal and Cirkewwa ferry terminal. In most of these projects, reclamation formed part of the project. In addition to these turnkey projects, the Works Department, through its Infrastructure Division, has carried out various other minor coastal works, in particular, road widening schemes along coastal strips.

8.11 In Malta, reclamation for the following types of infrastructure may be identified:

- Non-berthing infrastructure, such as road widening schemes, parking areas;
- Berthing infrastructure, such as quays and marshalling areas.

In-situ mass concrete gravity wall

8.12 Most coastal road widening schemes in Malta were carried out using a sheetpiled temporary cofferdam to act as a shutter for an situ mass concrete gravity wall.

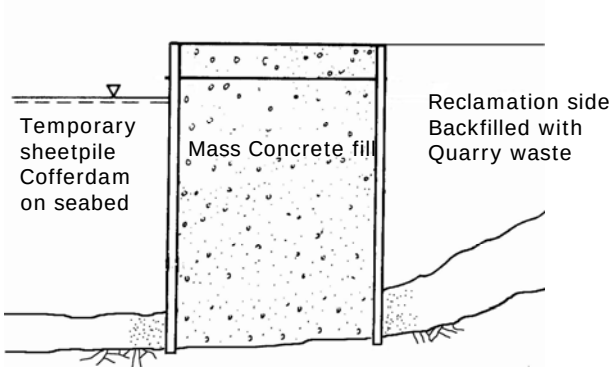

Figure 8-1: In-situ Mass Concrete Gravity Wall

8.13 The sheetpiles are usually placed or driven on or into the bedrock and held in place by an external frame while mass concrete is poured in between. Once the concrete sets, the sheetpiles are withdrawn and driven further down the alignment. Backfill is placed exclusively by tipper truck.

8.14 The best example of this type of structure is the Gzira seafront, from the ferries to the Manoel Island Bridge, which was widened from a two lane road to a four lane road plus promenade. Typical water depth is in the range of 3 to 5 metres.

Sealed precast concrete gravity wall

8.15 Precast I-Section units with mass concrete infill and horizontal concrete seals have been used for port reclamation as shown in Figure 8-2.

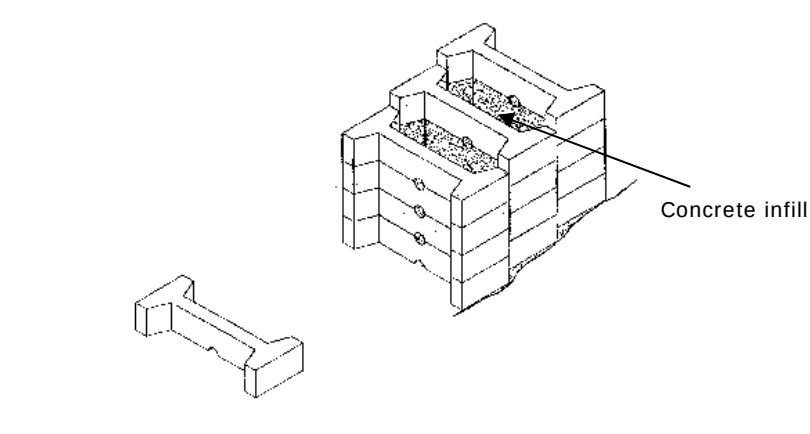

Figure 8-2: Sealed Precast Concrete Gravity Wall

Figure 8-3: Cirkewwa Ferry Terminal reclamation (Source: MMA)

8.16 The precast blocks are in the 10 tonne range; mass concrete is pumped in between the blocks to render the wall impermeable. A horizontal cavity across the block ensures complete sealing. Backfill is placed exclusively by tipper truck.

8.17 The reclaimed parking and marshalling area at the Cirkewwa Ferry Terminal (in water depths of 3 to 5m) was constructed in this manner, as shown in Figure 8-3.

Rubble mound bund

8.18 In areas where wave action is limited, the traditional rubble mound bund has also been used. Selected rubble was forward dumped and shaped into a rubble trapezoidal mound. Geotextile filter was then laid on the reclamation side and the fill dumped in place by tipper trucks. This technique is shown indicatively in Figure 8-4. Due to a shortage of good quality rock and loss of fines through the geotextile medium, this method is no longer in general use.

8.19 The reclaimed parking and marshalling area at the Mgarr Ferry Terminal in Gozo was constructed in this manner but the backfill had to be coarse grained to prevent loss of fines

through filter and subsequent settlement of the marshalling area.

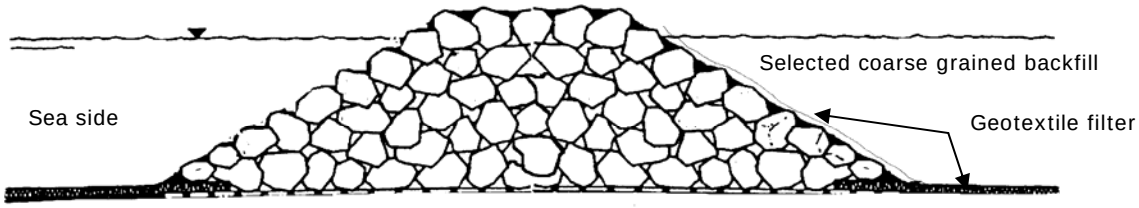

Figure 8-4: Rubble mound bund

Cyclopean gravity blockwork

8.20 Cyclopean blockwork in quays is very common. It traditionally consists of blocks in the 10 to 60 tonne range stacked in pillars. A geotextile filter fabric behind the structure normally guarantees sand-tightness.

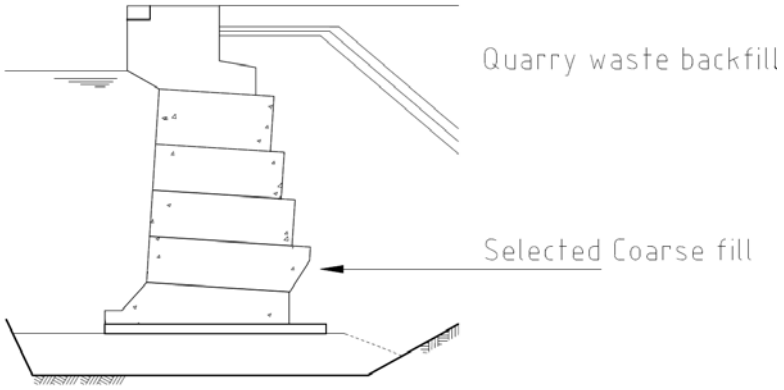

Figure 8-5: Cyclopean Blockwork

8.21 The quay wall at the Mgarr Ferry Terminal in Gozo (-5.50 m), the Viset cruise liner berths (-14.0 m), and Phase 1 of the Malta Freeport (-18.0 m), were all constructed in this manner. Whereas the quays in Gozo and at the cruise liner terminal were successfully completed without problems, improper construction methods led to serious oscillation problems in the vertical block pillars at the Freeport (Phase 1 Terminal) in the presence of long period swell. This method of construction was not used in Phase 2.

Caissons

8.22 Reinforced concrete caissons have been used both in breakwater and earth retaining structures.

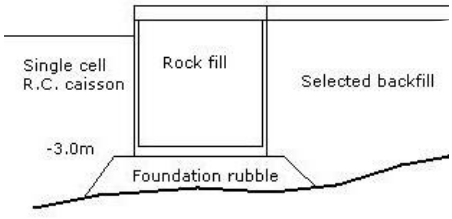

Figure 8-6: Single cell caissons (*left*) Hotel Excelsior waterfront (*right – Source: MEPA*)

8.23 The simplest form of caisson used is the single cell caisson, approximately 3 metres square, which was utilised to develop the waterfront adjacent to the Hotel Excelsior, next to Hay Wharf, as shown in Figure 8-7. These caissons were pre-fabricated inside a floating dock and floated out to the site.

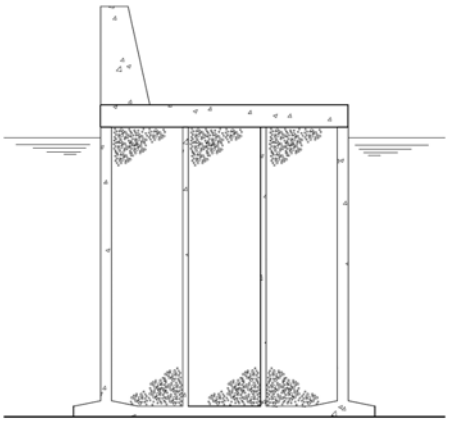

Figure 8-7: Multi-cellular deep water caissons at the Freeport breakwater

8.24 Conventional multi-cellular caissons for the main breakwater at the Malta Freeport were constructed at the Malta Dry Docks. The main breakwater consists of 30m x 30m caissons sunk into position on a pre-dredged Globigerina bedrock foundation.

Sheet piles

8.25 The lack of thick consistent sand beds around the coast of Malta makes it impractical to construct the traditional type of anchored sheet-piled quays. The only known use of permanent sheetpiles is in the construction of the Phase 2 Terminal at the Malta Freeport, where cellular cofferdams were utilised as the earth -retaining reclamation edge protection structures.

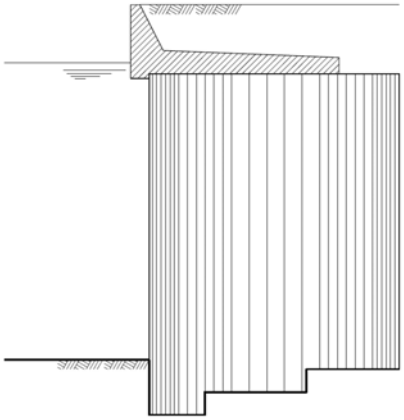

Figure 8-8: Cellular steel cofferdams

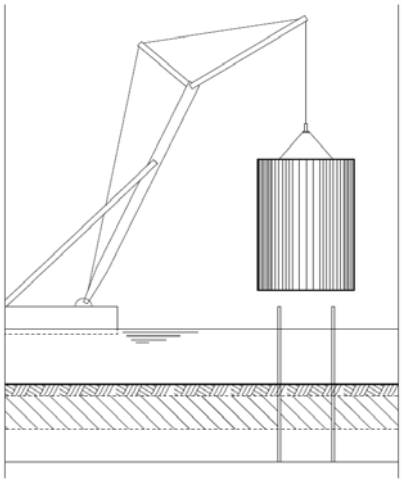

Figure 8-9: The installation of the cofferdams

8.26 The cellular cofferdams were pre-assembled on dry land using a horizontal circular template. The entire cell was then hoisted over two guide piles and driven into the globigerina sea bed, conveniently pre-fractured around the perimeter of the cell. The cells were then filled with selected globigerina fill and vibro-compacted to achieve the desired bulk density. The maximum operating draft is 18 m.

Conclusions

8.27 Three possible technically robust methods have been identified for protecting deep reclamations – rubble mound breakwater, concrete caisson and steel pile cellular cofferdam. The other methods presented are considered unsuitable or uneconomic for deep structures. The eventual choice of method would depend on the details of a specific scheme, its exposure to waves and the depth of water at the site, but a technically robust

solution is possible.

Reclamation Fill

8.28 It is likely that filling of the reclamation will commence once the edge protection structure is complete, or sufficient of it is complete to provide protection to the filling operation. Filling could be undertaken in two ways – either by end tipping from trucks or by bottom dumping from a fleet of barges. Of these two choices, use of trucks is much simpler and more economic. Use of trucks poses less additional handling, does not require the logistical operation of a fleet of barges and would be faster. Obviously, this method would require a land connection to the fill site, either by making the site contiguous with the mainland or by constructing a causeway. Use of barges necessitates double or even treble handling of material, to transfer it from trucks onto barges and vice versa.

8.29 Treatment of the fill material is likely to depend on the after-use of the reclamation scheme. As described in Chapter 5, Globigerina fill for the edge protection structure[39] for Malta Freeport Phase 2 was sieved to reduce the fines content and vibro-compacted to maximise the density achieved. This treatment was required in order to produce an internal angle of friction of 30° (required for stability reasons) in the fill material for the cells making up the edge protection structure. The end use of the reclamation for Malta Freeport as a container terminal means that the reclamation structure is subject to very high loads.

8.30 The example of the La Collete Phase 2 reclamation in Jersey (described in Chapter 5) illustrates the opposite extreme from Malta Freeport. Mixed-use development was constructed on the reclamation resulting in far less onerous loading than that on the Malta Freeport reclamation. During construction, there was no sorting or rejection of the supplied inert waste material and no engineered compaction took place.

8.31 Evidently increasing the level of treatment of the reclamation fill material will increase construction costs, but it also increases the loading capacity of the reclamation, which results in a wider range of potential after-uses.

8.32 The geometry of any proposed reclamation scheme will need to be carefully designed taking into consideration:

- Location of the reclamation development, potentially including planning constraints. At this stage it has been assumed that all areas within the -20m contour and within areas 1 and 3 are suitable, but this is addressed further in Chapter 15 Environmental Appraisal;
- Proposed after-use, potentially including the need for staged development;
- Seabed bathymetry which may dictate some areas are not viable for development because of the water depths involved – this has been addressed by the limit on reclamation with the -20m contour;
- Size of reclamation required relative to Globigerina generation rates (and hence

[39] Note that the general reclamation fill did not receive such intensive treatment.

project timescale) and available funding of scheme; this was addressed in Chapter 7, and is addressed further later in this Chapter under the heading construction sequencing;

- Environmental constraints which may mean that certain areas of the seabed cannot be developed upon – this is addressed in Chapter 15 Environmental Appraisal;
- Hydraulic performance of the reclamation in terms of its effect on local hydrodynamics and waves. – this is addressed in Chapter 7.

Construction Issues

Support Facilities

8.33 During construction of a reclamation structure, an area of land will be required on mainland Malta for support facilities and storage. This is particularly true in the case of construction of an artificial island, however, it also applies to a coastal extension scheme. The type of facilities that may be required, depending on the reclamation structure type and construction method include:

- Support facilities including offices for site staff and washrooms for employees;
- Storage area for Globigerina material delivered to site to be stockpiled;
- Sorting, sieving or crushing facility may be required depending on the method of construction;
- Storage area for processed Globigerina material following processing;
- Concrete batching plant area including silos, aggregate stockpiles, queuing area for trucks;
- Storage area for stockpiling of construction materials, potentially including steel reinforcement, timber, quarried rock, cement etc; and
- Storage area for tools, equipment and land-based plant.

8.34 Some of these items will require a secure area for storage. There will also be environmental issues associated with some of these items which will require careful management.

8.35 In addition to the items described above, if an artificial island is under construction, a marine frontage with loading and unloading facilities would be required to allow transport of material by barge between mainland Malta and the artificial island. This will entail additional works to create barging facilities.

Land Connections

8.36 If an artificial island is proposed, the connections between the island and mainland Malta will require careful consideration. Connection options include a bridge structure, causeway

or ferry service. Compared to a coastal extension scheme, each of these options will increase the complexity (in design and construction) both on the artificial island and also on mainland Malta.

Construction on Reclaimed Land

8.37 The after-use of any reclamation scheme will determine the amount and type of construction required on the reclamation. The foundation type for any structures will require careful design and will depend on the construction methodology of the reclamation itself.

8.38 If the reclamation fill were to be crushed prior to placement so that the maximum size is of the order of 100mm, foundations for buildings (independent footings or rafts) may be excavated in the compacted fill in the normal way. Crushed Globigerina also lends itself to standard pile driving.

8.39 If the fill material is not crushed prior to placement, problems may arise with unevenly sized boulders, in which case bored piles may have to be installed.

8.40 As previously discussed, the high fines content of Globigerina fill makes the reclamation susceptible to settlement, so construction of any structure sensitive to differential settlement should be avoided.

Other Construction Materials

8.41 As well as Globigerina limestone fill material, any reclamation project will require potentially substantial quantities of construction materials which must be economically sourced.

Construction Sequencing

8.42 Depending on the reclamation layout, it is likely to be necessary to construct a significant proportion, if not all of the edge protection structure before filling of the reclamation structure commences. It may be necessary to carry out the reclamation in a series of phases so that there is the potential for revenue to be generated from some areas of the reclamation while other areas are still under construction. This scenario will require careful programming to ensure that minimal construction nuisance is caused to the occupants of the completed phases during completion of the works. Sequencing is considered further in Chapter 12.25.

Overall Summary

8.43 Large-scale reclamation is technically feasible in depths up to 20m or so. Any reclamation will require provision of edge protection to prevent erosion and loss of material by the action of waves and tides. A number of possible methods for providing the edge protection have been identified – rubble mound, concrete caisson, steel cofferdam. Beyond the 20m depth contour, the technical challenges of edge protection become significant and the

project would be high-risk. The most cost effective way to place the fill is by end tipping of waste from trucks which collect the material at source – this is far more cost-effective than using barges to deposit material at the reclamation site. Therefore land reclamation contiguous to the mainland is more cost effective than creation of islands. The fill material may need to be processed if it is required to achieve high foundation strengths. If low loadings are envisaged, the need for processing may be removed. As well as Globigerina limestone fill material, any reclamation project will require potentially substantial quantities of construction materials – rock, good quality fill, concrete, steel - which must be economically sourced.

9 Opportunities for use of Land Reclamation

Introduction

9.1 This chapter identifies the potential after-use development of the reclamation. For the purpose of this study, subsequent use of any land created as a result of reclamation activities is termed 'after-use development'.

9.2 Current MEPA land use policies and plans were considered to determine the appropriateness and demand of the potential after-use developments. Since the majority of the plans and policies relate to future development in the context of existing land and land uses, the discussion of potential opportunities has been based upon professional judgement and has necessarily been kept broad to allow flexibility in the decision-making process in the future. It is noted that the policies and plans reviewed in this Chapter deal specifically with afteruses, taking the stance that if the reclamation were to proceed, what would be the best use; ie it addresses the question "what are types of land uses for which there is an overriding national requirement and which cannot be reasonably located on land already allocated for development". This approach therefore mandates that the reader also bears in mind the impacts resulting from the reclamation process itself, which are detailed elsewhere in the report.

9.3 Reference is made to Structure Plan and Local Plan policies that concern the coastline abutting the proposed reclamation Areas 1 and 3. A detailed description of these policies is found in Chapter 14.

9.4 Four broad categories of after-use have been identified. These include:

- Passive development;
- Mixed use;
- Tourism and recreation; and
- Industry and environmental infrastructure.

9.5 Each category of after-use has different implications in terms of costs, economic viability, private sector investment interest, environmental impact, and infrastructure requirements. While this chapter presents a discussion of a wide variety of potential after-uses, aspects of cost and potential returns on investments are detailed in Chapter 12.25, which examines the feasibility of the most economically feasible use, Mixed Use.

Potential land uses

Passive Development

9.6 Passive development is characterised by its enhanced community benefits, reduced capital costs and low ongoing maintenance costs. Typical passive development would be

a nature sanctuary and / or parkland for informal recreation.

Nature Sanctuary

9.7 The Maltese Islands have a range of typical Mediterranean habitats and a rich biodiversity, consisting of a number of different communities of native plants and animals. Many rare and indigenous species, including some endemic species, are threatened by development in rural and marine areas, the introduction of alien species and the exploitation of wildlife. Coastal habitats are particularly vulnerable to such threats.

9.8 The geology of the Maltese Islands presents numerous features of scientific interest. Some fossils and structural features are of local and regional interest because of the light they throw on the geological, geographical and biological evolution of the Islands and the surrounding lands. The Maltese Islands also have an interesting and attractive landscape, which is a product of the interaction of geology, climate and man. The limited land area and high population density of the Maltese Islands result in strong pressure being exerted on the natural environment, and the areas that are still undeveloped in particular. As a result, some geological sites are in danger of complete obliteration, while the scenic value of the landscape has been compromised by intrusive elements.

9.9 With mounting development pressure along the length of the eastern coastal zone, the need for nature sanctuaries along the coast becomes more evident. The development of a nature sanctuary would capitalise on the coastal nature of the sites abutting the reclamation areas and offer opportunities for academic research and public education.

Relevant policies for Area 1

9.10 The coastal area of Naxxar is of high ecological, scientific and scenic importance; it is identified in the Coastal Strategy Paper as a predominantly undeveloped and natural rural coastline. It is also an interesting landscape that offers a typical visual perspective of the Mediterranean coast.

9.11 The Central Malta Local Plan (CMLP) contains three policies aimed at conserving and safeguarding the natural and cultural value of the Naxxar coastal area:

- **NA 04 Protection of the Natural Coastal Area**: MEPA will not permit urban development along the open coastal area of Naxxar, between Ghallis and Bahar ic-Caghaq, as designated in the Naxxar Coastal Policy Map. All efforts will be made in order to retain or reinstate these designated areas in their natural state;
- **CG 22 Protection of SACs, SSIs, AEIs and AHLSs** safeguards the coastal garrigue along the Naxxar coastline as an AEI and SAC;
- **CG 25 Protection of Strategic Open Gaps**: Since central Malta is heavily urbanised, strategic open gaps situated outside development zone and between settlements are priority areas that require protection. Any further urban development in these areas would seriously degrade existing landscape settings and possibly damage natural habitats.

Relevant policies for Area 3

9.12 The coastal area along Area 3 is also important in terms of ecology and geology, although it has been threatened by misuse related to flytipping, and hunting and trapping.

9.13 The Grand Harbour Local Plan (GHLP) and South Malta Local Plan (SMLP) include policies that designate parts of the coastline as Sites of Scientific Importance and Areas of Ecological Importance:

- **GK 15 Sites of Scientific Importance**: The bay of il-Kalanka tal-Patrijiet is of significant importance (level 2) in terms of geomorphology, stratigraphy, palaeontology and structural geology. The Wied Ghammieq Cross Fault is 'one of the few remaining cross faults which formed the Grand Harbour drainage system' (GHLP Geological Survey: Malta University Services 1995), and the site has significance in relation to structural geology, geomorphology and hydrology (level 4).
- **SMCO 03 Protection of Areas of Ecological Importance and Sites of Scientific Importance**: The following areas are recommended to be proposed for scheduling, as Areas of Ecological Importance (AEIs) and Sites of Scientific Importance (SSIs): maritime garrigue communities along the coast from Tan-Nisa to Blata l-Bajda (Xghajra); coastal stretch between Xghajra, Zabbar and Zonqor Point (Marsascala); coastal cliff at Ghassa tal-Munxar (Marsascala); rocky coast from Xifer ic-Cerna to il-Ponta tal-Mignuna (Marsascala); and l-Ilsien to Ghar ix-Xama (Marsascala). In these protected areas / sites there will be a general presumption against development that would create negative impacts on these areas / sites. MEPA will endeavour to safeguard and protect these areas / sites.
- **SMIA 13 National parks**: The SMLP designates the area known as L-Ghassa tal-Munxar (Marsascala) and the coastal stretch between Il-Ponta taz-Zonqor (Marsascala) and Blata l-Bajda (Xghajra) as National Parks primarily for informal recreation (e.g. walking, cycling) and the appreciation of the ecological, geological, archaeological as well as cultural-historical features of these areas. Within these parks, priority will be given to the conservation, protection and improvement of the natural and cultural-historical heritage. Positive provision will also be made for recreational uses consistent with this objective.
- **SMCO 05 Promote and safeguard public access along the coast**: MEPA will safeguard public access and encourage initiatives to rehabilitate the coastal stretch, in accordance with the characteristics of the areas between Xghajra and Marsascala. Development that prohibits or restricts public use of the coast will not be permitted. The primary objective is to safeguard and promote the coast as a public open space. This policy is also relevant to the afteruse development of the reclaimed areas as parkland for informal recreation.
- **GE 03 Areas of Open Space**: Areas of formal and informal open space (both public and private) located outside the built-up area, and which add significantly to the amenity of the locality, will be protected from development. There would therefore be a presumption against development in such areas, especially

development which would remove or adversely affect these spaces.

Parkland for informal recreation

9.14 Figure 9-1, below shows a purely indicative artist's impression of a parkland development for reclamation shape 1c in Area 1. It should be noted that this is not a proposal, merely an illustration.

Figure 9-1: Parkland development for reclamation shape 1c (purely indicative)

9.15 The development of parkland for informal recreation entails the provision of infrastructure to permit the greater enjoyment of the countryside by both residents and tourists.

9.16 This after-use development is supported by Structure Plan policies. Through Policy REC 13, MEPA seeks to identify and establish a network of country parkways and coastal rights-of-ways for footpaths, cycle routes and horse riding trails. Where possible, these are to facilitate the creation of circular routes and have regular links to natural or man-made attractions and facilities. One of these routes includes the Coastal undulating area between Salina Bay and Bahar ic-Caghaq. MEPA has indicated that it will also identify and designate a series of picnic areas within the parkway system (Policy REC 14). These will include all support facilities, designed to be sympathetic with the natural setting of the sites and will act as recreational magnets that will attract countryside users from vulnerable conservation sites.

9.17 The Coastal Strategy Topic Paper states that the type and level of new development acceptable within coastal areas should be minimal. Only development that is directed towards improving degraded areas and enhancing informal recreation, in conformity with the objective of safeguarding the coastal characteristic and heritage of such areas, would be acceptable.

Relevant policies for Area 1

9.18 Although Naxxar is highly built up, the coastal area is the only undeveloped pristine coastal area between the intensely developed Qawra / Bugibba area and Pembroke / St Julians.

9.19 There are three policies in the CMLP that promote the use of the coastline abutting the reclaimed land in Area 1 as parkland for informal recreation:

- **CG 26 Promotion of Heritage Trails and Walkway Routes** supports the introduction of a Coastal Walkway Route along the Naxxar coastline, in line with Policy REC 13.
- **CG27 Environment Management Plans**: MEPA will only consider proposals for recreation related developments in the Naxxar coastal area, subject to the recommendations of the relevant Environmental Management Plans.
- **NA 05 Improvements at Bahar ic-Caghaq**: The recreational area of Bahar ic-Caghaq is to be further developed and upgraded with suitable and compatible developments.

Relevant policies for Area 3

9.20 The SMLP promotes the utilisation of the coastline abutting Area 3 as a national park and walking & cycling route:

- **SMRE 02 Walking & cycle routes and heritage trails in urban and rural areas**: MEPA will encourage Local Councils, NGOs as well as other public and private agencies to promote the development of and the maintenance of walking and cycle routes and heritage trails along the coastal stretch between Xghajra, Zabbar and Marsascala;
- As explained earlier, the SMLP designates the area known as L-Ghassa tal-Munxar (Marsascala) and the coastal stretch between Il-Ponta taz-Zonqor (Marsascala) and Blata l-Bajda (Xghajra) as National Parks (SMIA 13).

Conclusions

9.21 Passive development allows for informal leisure activities and the enjoyment of the maritime landscape.

9.22 Natural sanctuaries would allow for the expansion of the protected areas and their characteristic habitats and species. This would make up for the loss of habitats and biodiversity due to the loss of rural areas and open countryside over the last 50 years.

9.23 The tourism sector is increasingly acknowledging the benefits of retaining and protecting the natural coastline, which portrays the beauty of the Mediterranean coastal setting and landscape in its original state as a tourist product in its own right.

9.24 Passive development would generate very minor negative environmental impacts that would affect the adjacent coastal areas, notwithstanding the fact, however, that the impacts of the reclamation itself on the benthos within and in the vicinity of the reclamation is in most cases likely to be considerable. While additional space for informal recreation or nature sanctuaries could be seen as desirable in a country that has one of the highest population densities in the world, it is difficult to identify it as an overriding national demand.

9.25 Passive development in Area 1 is compatible with:

- Protected historic buildings (scheduled military architecture);
- Agricultural areas (Policy CG 24) awaiting classification;
- Listed areas / sites of scientific importance (Policy CG 22);
- Scheduled areas / sites + Special areas for conservation;
- Listed ecological areas / sites (Policy CG 22);
- Listed archaeological areas / sites with buffer zones;
- Areas of High and Very High Landscape Sensitivity (Policy CG 22); and
- Protected natural coast with public access (CMLP Policy NA 04).

9.26 Passive development in Area 3 is compatible with:

- Site of Scientific Importance / Area of Ecological / Geological Importance;
- National park (Policy SMIA 13);
- Agricultural areas (Policy SMAG 01);
- Protected historical sites (military entrenchments); and
- Public urban open space (Policy SMSE 04).

Mixed Use

9.27 Mixed use development includes a combination of residential, commercial and leisure facilities. A purely indicative artist's impression of a mixed use development for reclamation shape 1c in Area 1 is shown in Figure 9-2.

Figure 9-2: Mixed use development for reclamation shape 1c (purely indicative)

Residential

9.28 Housing is the major land use of the Maltese Islands, comprising 33% of the land uses (State of the Environment Report, 2005). It is estimated that by year 2010, approximately 22,000 new housing units will be required in addition to units which already exist (Structure Plan 1992). This does not include additional housing units to be used as second homes by Maltese or let to short-stay tourists. To achieve this net increase, a larger number of dwellings will need to be created to replace housing which is lost due to redevelopment, demolition for infrastructural works, and changes from residential to non-residential use. The Temporary Provision areas are not extensive enough to contain all the new housing units and ancillary facilities (Structure Plan, 1992).

9.29 However, of the available housing stock, 53,135 units (27.6%) are vacant (National Statistics Office, 2007). There is, *prima face* therefore no housing shortage in the Maltese Islands. The current rent legislation and the high investment potential of property have, however, encouraged the development of new residential units rather than the take up of vacant properties.

9.30 At face value, it would appear that to meet the requirement of additional housing units in the future, rather than adding more land, the solution would be to improve the overall efficiency of land use by making use of the vacant properties, redeveloping derelict units, and reinforcing confidence in the rental market through, for example, modification of the rental laws. The vacant property / rental market issue lies outside MEPA's land use remit; MEPA's overall strategy is to permit and, where appropriate, to initiate and encourage,

redevelopment and development in existing built-up areas.

9.31 A key target of the 1992 Structure Plan was to contain urban sprawl within the development boundary defined by the 1988 Temporary Provisions Schemes and the Primary Development Areas. In Policy HOU 7 of the Structure Plan, MEPA seeks to reduce the demand for new house building through the optimal use of existing housing stock which can partly be achieved through the establishing of an equitable rental market.

Commercial

9.32 Commercial land uses include office accommodation and retail.

9.33 The latest data show that the sales area of convenience and comparison goods retail floor space is almost 274,000 m^2 (Retail Topic Paper, 2001). This represents 60% of the total retail sales area of 450,000 m^2, which also includes retail services (30%) and motor vehicle showrooms (10%).

9.34 Since the publication of the Retail Topic Paper, retail development has expanded rapidly in the Maltese Islands; the viability of the small neighbourhood grocer has strongly been challenged by large supermarkets situated outside town centres.

9.35 Estimates of floor space requirements assume an average annual increase in the Turnover Floor space Ratio of 2% throughout the study period (2000 to 2020). This implies a net requirement for an additional 115,140 m^2 of sales area by 2020. MEPA planning applications database show that 47,879m^2 has been approved between 2000 and 2003.

9.36 According to the Retail Topic Paper, the additional floor space requirement may be accommodated through:

- Growth in existing primary and secondary centres;
- Expansion of existing tertiary and village centres;
- Development of additional, out-of-centre projects;
- New showrooms and supermarkets outside existing town centres; and
- New and expanded neighbourhood.

9.37 The Structure Plan identifies a shortage of private sector office accommodation, and it is probable that demand will continue at a high level during most of the Structure Plan period as the proportion of total jobs found in this sector increases.

Leisure

9.38 Leisure developments include indoor and outdoor formal sports facilities and open public spaces in urban areas.

9.39 The Leisure and Recreation Topic Paper supports the provision of new sports facilities at a local and national level: new football, cycling, model aircraft, snooker, martial arts,

bodybuilding, badminton, squash, handball, fitness and bowls facilities are needed in specific locations, whilst an upgrade of existing tennis, athletics, hockey, netball, basketball, volleyball, cricket and rugby facilities would suffice.

9.40 The Leisure and Recreation Topic Paper encourages leisure initiatives, the reuse of vacant or derelict dwellings and infill sites as attractions and a more varied distribution of entertainment facilities. The Topic Paper recommends against the provision of a permanent theme and / or leisure parks.

9.41 The national strategic objective for open recreational space provision (including public gardens, playgrounds, playfields and other open spaces) as indicated in the Recreation Topic Paper is to achieve 2.4 m^2 per person, which is far higher than the existing 1.3 m^2 per person in the central localities. It is clear, therefore, that nationally the provision of sports and recreational areas is lacking.

Relevant policies for Area 1

9.42 Policy REC 5 of the Structure Plan states that MEPA encourages the development of land at Pembroke for an athletics track, uncovered heated freshwater swimming and diving pools and gymnasium.

Relevant policies for Area 3

9.43 The ratio of sports facilities per inhabitant in metres squared in the SMLP area stands at 1.9 m^2; it is the lowest when compared to other Local Plan areas. Furthermore, since most of the sports facilities are located within public schools, the use of such facilities is not generally available to the local residents and the general public.

Conclusions

9.44 Mixed land afteruse development entails the construction of new residential, commercial and leisure facilities on the reclamation areas.

9.45 Most residential, commercial and leisure uses are not suitable afteruse development on the reclamation areas because there is a policy direction to accommodate them inside Development Areas and to reuse vacant or derelict dwellings and establishments.

9.46 In the case of residential use, the substantial levels of vacant dwellings coupled with the recent extensions to the Development Areas militate against any arguments to justify the release of additional land for housing, or to justify the creation of new land on the basis of overriding national demand.

9.47 Due to visual impact, noise and air pollution, increase in traffic flow and reduction of access to the coast, mixed land use is likely to be incompatible with the following policies and protected sites:

Area 1

- Listed areas / sites of scientific importance (Policy CG 22);
- Scheduled areas / sites + Special areas for conservation;
- Listed ecological areas / sites (Policy CG 22);
- Listed archaeological areas / sites with buffer zones;
- Areas of High and Very High Landscape Sensitivity (Policy CG 22); and
- Protected natural coast with public access (CMLP Policy NA 04).

Area 3

- Site of Scientific Importance / Area of Ecological / Geological Importance;
- National park (Policy SMIA 13);
- Protected historical sites (military entrenchments); and
- Public urban open space (Policy SMSE 04).

Tourism and Recreation

9.48 By its very nature, reclamation of land from the sea lends itself to afteruse development with a tourism and recreational theme. Tourism and Recreation developments refer to the provision of accommodation and recreational facilities that are primarily intended for tourist use. The necessary mix of uses would vary according to demands, but possible tourism uses include hotel and resort development, golf courses, beaches and yacht marinas. As for passive development described earlier, this could be linked with activities to develop submarine habitats to further promote SCUBA diving opportunities, which is an established tourism and recreational past time in Malta.

9.49 Tourist arrivals in the Maltese Islands have increased from 12,583 in 1959 to 1,243,510 in 2007, with the largest age bracket comprising tourists aged 45 – 64 (National Statistics Office, 2008). Tourism contributes more than one billion Euros to the Maltese economy (approximately 25% to the Gross Domestic Product of the Maltese Islands) and accounts for 28% of the full-time equivalent employment (National Statistics Office, 2008). The Maltese Islands have promoted the coastal environment as a main tourist attraction and subsequently the measures taken over the years to build up a strong tourism industry have been directed towards coastal development. Tourism infrastructure related to the coast is mainly associated with the availability of accommodation in terms of hotels and holiday apartments. The associated products are mainly related to beaches. This trend to maximise and exploit coastal areas continues to date; most of the tourist projects undertaken over the last decade have been located on the coast. The main tourist localities on the coast are St.Paul's Bay, Sliema, St. Julians, Valletta, Marsaxlokk, Marsascala and Mellieha (in Malta), with Xlendi and Marsalforn in Gozo.

9.50 The trend for developing coastal areas for tourist accommodation has taken up extensive areas that were previously utilised or could have been promoted for walking, bathing and

other recreational activities. This trend has undermined the available space for informal recreation even for visiting tourists. This is an important issue on an island were the principal experience of open space is the coastal environment.

9.51 The Ministry of Tourism's policy, as indicated in the Strategic Plan 2000-2002, supports a strategic direction already highlighted in the Tourism Development Plan for the Maltese Islands, of diversification, seasonality and product development. Of particular significance is the strategy aiming to 'encourage the development of new or improved recreational or cultural facilities, with less emphasis on accommodation and on increase in bed stock'.

Hotel and resort development

9.52 In 1992 it was estimated that some 4,000 additional tourist rooms will be required by the end of the Structure Plan period (Structure Plan, 1992). MEPA recommended that this additional accommodation should be located in existing built-up areas by extension and conversion of suitable buildings and the development of infill sites or in areas to be developed, namely the Development Zones. In 1994 there were 17,670 tourist rooms available in the Maltese Islands (National Statistics Office, 1998). The tourist rooms have since increased by 54 to 17,724 rooms in 2008 (National Statistics Office, 2008). The net occupancy rate of these tourist rooms in the period 2007-2008 varied between 33.3% and 34.9% (National Statistics Office, 2008).

9.53 MEPA believes that considerable potential for the development of tourist accommodation exists in the Urban Conservation Areas designated in the Structure Plan because of the known preference of upmarket tourists for accommodation located in areas of high quality urban environment.

9.54 MEPA sees its first task as encouraging tourism while preventing the further spread of tourist buildings and associated facilities outside areas already committed to such uses. Its second main task is to encourage the further development of the tourist industry by concentrating its energies and further investment in the refurbishment and upgrading of existing facilities in existing built-up and developed areas, and by assisting in the general 'up marketing' of the industry.

9.55 SMTO 01 New Tourism Accommodation developments of the SMLP states that new tourism accommodation development will only be considered within designated Entertainment Priority Areas and areas designated as Resort Zones and in the form of conversion, extension and refurbishment of existing vacant buildings and facilities within the Urban Conservation Areas of all localities, in line with Structure Plan Policy TOU 9.

9.56 According to Policy MTO 03 Camping and Touring Caravan sites of the SMLP, MEPA will consider proposals for the provision of camping and touring caravan facilities along the eastern coastal stretch of the Local Plan area at Zonqor Point (Marsascala).

Golf courses

9.57 Existing golf facilities are limited to the Royal Malta Golf Club at Marsa.

9.58 There is a recognised and substantial international demand for golf courses as components of tourism development, particularly to support the Conference and Incentive sector.

9.59 The Golf Course Development policy paper identified that initially one golf course is to be considered, although, other developments are being proposed, especially on Gozo. The consultants who prepared the Golf Course Subject Study state in their report that "in terms of overall demand there appears to be a need for at least two high quality courses in Malta in addition to the existing course at Marsa.

9.60 A major disbenefit is that no developer can now afford to open up a golf course in isolation; development economics dictate that courses have to be profitable and this must be accompanied by profit - making urban development (high value residential areas, hotels, etc.) since golf courses alone do not produce profit.

9.61 Golf courses require extensive areas of land (60 ha for a modern 27-hole course), land assembly is a major criterion of implementation. Although considerable volumes of water, fertilisers and pesticides are required to operate a golf course, the key issue is rather one of biodiversity; whether the benefits arising from additional golf course(s) are sufficient to challenge the biodiversity of protected habitats through the introduction of warm weather golfing grass such as *Paspalum vaginatum* or the more water and pesticide –hungry bentgrass varieties. The various EIA studies for golf courses also indicate that the addition of two courses would not render Malta as a golf destination.

Beaches

9.62 Due to the rocky nature of coastal zone, Malta does not have many sandy beaches suited to tourism. Sandy beaches make up only 2% of the Maltese coastline and most of them have been degraded through road construction or the development of concrete platforms. As a tourism product, Malta's beaches cannot meet the capacity of the tourists encouraged to visit the islands. Consequently the idea to replenish smaller, already degraded beaches or create new ones is attractive.

9.63 MEPA recognises that sandy beaches are one of the country's most valuable resources especially due to their recreational use by the local population and by tourists. According to Policy RCO 23 of the Structure Plan, developments connected with the enlargement of existing beaches and the creation of new ones will only be allowed following a scientific study by competent persons of their short-term and long-term environmental, social and economic impact and provided that it is clearly demonstrated that there is a real need for such development and that the benefits outweigh the negative impacts. To date only two beaches have been created or extended: Pretty Bay, which was extended at the time the Freeport was constructed, and St George's Bay, which was replenished in 2004.

Yacht marinas

9.64 Annex B of the Appendices addresses the demand for marinas in some detail. The main arguments and conclusions are summarised below.

9.65 Leisure boating and yachting has increased substantially in popularity during the last 30 years. The Mediterranean is a hive of yachting activities and the yachting industry is a well-established and important contributor to many Mediterranean economies. Over the period 1994 - 2004 years there has been a 67% growth in the number of yacht marinas across the Mediterranean.

9.66 As in other Mediterranean countries, boating and yachting in Malta has long been a popular recreational sport. Malta is in a strategic location to reap the benefits from the stop-over traffic cruising the Mediterranean. Language, the social environment and the availability of good quality chandlery and yard services are perceived as advantageous qualities to promote Malta on the international yachting scene. It was estimated that in 1995 the yachting industry generated 10 million Euros in the Maltese economy. About 40% of the total contribution is estimated to be from international yachtsmen. The Yachting Subject Study predicted that the industry would generate a total of more than 23 million Euros by the year 2007.

9.67 The total number of yachts registered in Malta is approximately 6,800, being 1,800 pleasure yachts under the Malta flag and just under 5,000 seacraft on the small craft registry. Between 1994 and 2004, the number of marinas increased from two to five, and the number of berths from 1,056 to 1,800, at approximately 73 berths per annum. Although this is broadly in line with the growth predicted in the Yachting Subject Study, this represents a slower rate of growth than the rapid increase experienced over the period 1989 to 1993, when the number of berths rose from 364 berths to 1,056 berths, representing an increase of 173 berths per annum. Malta's ratio of 2.1 boats per 100 members of the population represents a high penetration of yacht ownership relative to other European countries. All of this may suggest that Malta's overall level of yachting penetration may start to reach saturation levels, and that past rates of growth in boat ownership may not continue at the same pace in the future.

9.68 Planned berthing facilities and marinas in the Maltese Islands include:

- Dock One project, adjacent to Grand Harbour Marina: This might increase the overall number of berths in Dockyard Creek very marginally in 3 to 5 years time.
- Hondoq ir- Rummien, Qala, Gozo: The provision of 100 - 150 berths, depending on the configuration and granting of permission for development by MEPA;
- Manoel Island Yacht Marina: When the MIDI development on Manoel Island goes ahead, the Manoel Island yacht marina is likely to be expanded slightly through the addition of another pontoon;
- Marsamxett Harbour: It is likely that, as a result of an agreement with MIDI and Government, the Royal Malta Yacht Club will provide berthing for visitors at Marsamxett Harbour, to support specific club activities such as the Middle Sea Race. This would probably be a seasonal facility.
- Xemxija and Marsaskala: It is understood that MMA is studying the construction of

a 200+ berth marina at Xemxija, and possibly another at Marsascala Bay.[40]

9.69 Other planned facilities are on a small scale and ancillary to landside developments. Between them it is thought that they would contribute to only a marginal increase in berths. However, when added to the vacant berths still available at Grand Harbour Marina, the supply of marina berths will probably equate to demand for the next few years.

9.70 The increase in the supply of berths to date has resulted in an overall position that is very similar to the headline estimated in the Yachting Subject Study, which envisaged a requirement for 2,000 berths by 2007.

9.71 However, the difference is that local demand has remained a key component part of the overall composition of demand, and that not all the marinas have full occupancy, so that some aspects of demand has risen at a slower pace than originally envisaged. Certain market segments, such as yacht chartering (insufficient demand, two failed attempts by specialist companies), visiting yachtsmen (high fuel prices to visit, alternative nearby cruising grounds, cheaper destinations) and unattended wintering yachts (insufficient hardstanding, possibly insufficient promotion) have failed to materialise to the extent envisaged, whilst other market segments, such as super yachts (very attractive bunkering prices) and local demand (steady annual growth), have exceeded original estimates.

9.72 Demand for marina facilities once the marinas in the pipeline are at or close to capacity will in part depend on whether the marina is part of an overall residential development or not. National demand for permanent berths by local yachtsmen is likely to slow down but will still be in the region of 40 to 50 berths per annum across all marinas (see Annex B). A marina should also cater for around 15 to 25 berths for larger yachts for international visitors. If the marina is part of a Portomaso-style development, then demand will be much stronger and could justify a larger marina. However, the extent of this demand will then depend on the overall development, its business plan, and marketing strategy. It is assumed that by the time a marina development on reclaimed land opens in say 15 years, the existing capacity at Grand Harbour Marina and any capacity brought on stream at the Excelsior and other marina expansion / development will be fully taken up.

SCUBA diving

9.73 The coastal waters of the Maltese Islands provide a number of opportunities for diving. The Maltese Islands offer optimal conditions to learn SCUBA diving with clear, relatively calm, warm and clean seas. The underwater geomorphology, with sheer drop-offs and caves, and a number of wrecks from the Second World War, offer interesting attractions to divers.

9.74 SCUBA diving is a very important tourist niche market, attracting 55,000 tourists each year or about 4% of the tourist market (National Tourism Organisation Survey). Local practitioners have also increased over the last 10 years. Given the limited size of our islands, new diving experiences are being sought.

[40] See Northwest and South Malta Local Plans

9.75 There is general consensus that the diving product needs to be upgraded due to lack of proper facilities for divers (e.g. toilets, showers, kitting up areas), inadequate parking areas, litter, access problems, lack of security, lack of easy entry and exit points, water pollution and general lack of fish. (Malta Tourism Authority Surveys (1999-2001)). Diving tourism is very seasonal, with 52% of divers visiting the islands between July and September. Up till now, the Maltese Islands have not been marketed as a winter diving destination.

9.76 The environmental impacts associated with diving are minor and include mechanical dislodgement of sessile organisms, turbidity caused by and air bubbles, and reduction of the local fish stock by harpoon fishing.

Policies for Area 1

9.77 Policy NA 05 in the CMLP supports further development of Bahar ic-Caghaq as a recreational area for tourists and the local public.

Policies for Area 3

9.78 The urban settlements in the GHLP and SMLP areas are generally highly urbanised with very few pockets left for public open space (e.g. gardens, piazzas and playgrounds). Only 5% of the urban zone in the plan area is taken up by open spaces. The highly urbanised character of certain localities in the plans areas decreases the quality of the urban environment and reduces the quality of living for the residents.

9.79 **SMRE 01 Provision and Retention of Recreational and Sports facilities**: MEPA will encourage the development of new and the improvement and upgrading, as well as extension, of existing recreational/sports facilities within the urban settlements, provided this will not create any significant adverse impacts to the locality, as well as the multi use of existing facilities whilst ensuring their retention.

9.80 **GD 10 Development of new attractions and facilities**: This policy is intended to establish the generally favourable attitude of MEPA towards tourism expansion in the GHLP.

Conclusions

9.81 The creation of an artificial beach and the development of submarine habitats to promote SCUBA diving suited to afteruse development of the reclaimed areas. They are compatible with the protected and scheduled coastal areas, provided the sewage treatment plant is commissioned. SCUBA diving is also compatible with passive afteruse development.

9.82 Government has identified the need for more golf courses, and given that numerous site identification studies and planning applications have not identified a single suitable site, it may be construed that there could be a demand for land for golf courses. However, while it would be difficult to argue that one or two more golf courses would not enhance Malta's attractiveness for conference and incentive tourists, such a small number of courses would

not make Malta a golfing destination. Taking account also of the environmental challenges associated with golf courses, particularly the fact that potable water is a scarce resource in the Maltese Islands and is under intense pressures from competing users (SOER, 2005), and the fact that the proper husbandry associated with the use of *Paspalum vaginatum* would minimise the consumption of water, pesticides and fertilisers, over-riding biodiversity and sustainability concerns remain. It would be difficult, therefore, to justify the provision of land for golf courses as an overriding national land use requirements. The afteruse development of the reclaimed areas as a golf course is not recommended.

9.83 Although the supply of existing and planned yachting berths should satisfy the demand in the foreseeable future, there may be a market demand that is foreign-led and associated with a Portomaso-type development at the time that a reclamation based development would be completed, say in 15 years time.

9.84 However, since current policy is to direct the development of hotels and resorts to coastal areas already developed or committed to such uses, and given the substantial surplus of dwelling supply over demand, Portomaso-type afteruses are not supported and cannot be classed currently as an overriding national demand.

9.85 Furthrmore, as a result of visual impact, water, noise and air pollution, increase in land and sea traffic and reduction of access to the coast, the afteruse development of hotels and resorts, golf courses and yacht marinas is likely to be incompatible with the following policies and protected sites:

Area 1

- Listed areas / sites of scientific importance (Policy CG 22);
- Scheduled areas / sites + Special areas for conservation;
- Listed ecological areas / sites (Policy CG 22);
- Listed archaeological areas / sites with buffer zones;
- Areas of High and Very High Landscape Sensitivity (Policy CG 22); and
- Protected natural coast with public access (CMLP Policy NA 04).

Area 3

- Site of Scientific Importance / Area of Ecological / Geological Importance;
- National park (Policy SMIA 13);
- Protected historical sites (military entrenchments); and
- Public urban open space (Policy SMSE 04).

Industry and Environmental Infrastructure

Port-related activities

9.86 The shipping industry in the Maltese Islands revolves around the Grand Harbour and the Malta Freeport Terminal at Birzebbugia.

9.87 The Grand Harbour has a number of wharves that cater for a variety of services. The main activities are associated with cruise vessels, general cargo handling, ship repair and the provision of storage. Other services include the grain terminal, tank cleaning facilities, mooring facilities for super yachts and ferry services. Recent efforts to regenerate the Grand Harbour include the expansion of the Car Transhipment Stacking Area at Corradino Heights, the development of an international marina at Cottonera Waterfront and the development of the Cruise Liner Terminal.

9.88 Due to Valletta's role as a World Heritage site and Malta's primary centre of authority, public administration, shopping and cultural activities, there has been an effort to relocate heavy port uses from the Grand and Marsamxett Harbours to Marsaxlokk Bay (Marsaxlokk Bay Local Plan).

9.89 The Malta Freeport Terminal, located in Marsaxlokk Bay, is a transhipment logistic centre carrying out activities including container handling and industrial storage. The Freeport handles around 80% of local imports and exports and provides local entrepreneurs with network connections with around 100 ports worldwide on a weekly basis. The Malta Freeport is currently operating at close to maximum capacity. As a result of the increasing demand in the industry, and in order to avoid congestion at the port, Malta Freeport Terminals Ltd is seeking planning permission to expand its facilities to be able to increase its efficiency and improve turnaround times for vessels.

9.90 Once the Malta Freeport Terminal reaches operating capacity it will need to be expanded through additional reclamation in the vicinity of the current facility or a new terminal would need to be constructed elsewhere, possibly on reclamation in either Area 1 or Area 3.

Industrial activities

9.91 The majority of manufacturing industrial development in the Maltese Islands is concentrated in 12 industrial estates (Table 9-1). Industry in the Maltese Islands includes manufacturing and ship-building. Industry in the manufacturing sector includes textile and clothing, metal products, machinery, transport equipment and food and beverages. The vast majority of industrial activities are micro enterprises employing less than five people.

Table 9-1: Industrial estates and total floor space

Location	Total floor space (m^2)	Floor space vacant (%)
Attard	21,271	6.9
Bulebel	168,320	1.4
Hal Far	281,370	3.3
Kirkop	38,000	0
Kordin	80,533	9.3
Marsa	168,432	5.1
Mosta	41,743	3.6
Mriehel	51,372	2.5
Ricasoli	62,525	16
Safi	26,151	0
San Gwann	115,716	5.6
Xewkija	52,480	6.1
Total	**1,107,913**	

Source: WS Atkins (2001)

9.92 The Structure Plan forecasts indicate that additional land should be allocated for new manufacturing industrial development during the Plan period in addition to completing the development of existing industrial estates. Industrial firms generally seek reasonably flat land with good local access and adequate utility services. Even when well-designed, industrial development can have substantial environmental impact, and the location of new industrial estates must be considered with great care in terms of their impact on other uses and the environment generally. Additionally, the constraints on undeveloped land imposed by conservation policies mean that there are now fewer areas in the Islands suitable for further industrial development.

9.93 Malta Enterprise predicts a demand for Malta over the period 2008 – 2013 for 230,800 m^2 industrial space of which 56% would be for pharmaceutical industries, and 23% for incoming industrial tenants and the balance is to cater for the expansion of existing industry (Malta Enterprise).

9.94 To cater for this demand, MEPA's strategy is to encourage the conversion and rehabilitation of existing buildings in traditional warehouse areas where adequate access exists or can be arranged (Structure Plan, 1992). For example, Policy IND 3 of the Structure Plan states that development of retail warehouses and showrooms will not normally be permitted on sites other than those in or adjacent to storage warehouse areas.

Desalinisation plants

9.95 Desalination is an important contributor to Malta's potable water supply, currently providing 32%. However, while recognising that Malta's groundwater aquifers are seriously at risk from over-exploitation and pollution, and that the importance of desalinisation as a freshwater source is likely to increase, the fact that the four public desalination plants are running well below capacity would suggest that it would be difficult to justify the provision of additional plants.

Wastewater treatment facilities

9.96 Only approximately 6.4 % of sewage discharged at sea was treated in 2004. The national target was to ensure that untreated sewage would no longer be dumped at sea by 2007. Malta had thus committed itself to constructing three new wastewater treatment plants by this date that would cater for all the demand in the Maltese Islands. Only two of the three sewage treatment plants planned to treat all of Malta's sewage by 2007 have been completed by the target date (Xghajra, Malta and Ras il-Hobz, Gozo). The third wastewater treatment plant will be built at Ta' Barkat, close to the Smart City Malta scheme at Ricasoli. It is assumed that no seawater pollution results from the operation of the new wastewater treatment plants.

Conclusions

9.97 Current Government thinking does not support the relocation of existing bad neighbour facilities to a dedicated reclamation area. New port-related and industrial activities are better located in areas already devoted to such facilities. Should the stance on the relocation of bad neighbour facilities be reviewed, or once space for bad neighbour or port facilities reach capacity, there may be the necessary demand to consider the reclaimed areas for the development of new port-related and industrial activities. However, on the basis of current policies and plans related to industrial and port-related afteruses, there is no evident overriding national demand.

9.98 However, even if there were such an overriding national demand it is noted that such industrial and environmental infrastructure afteruses are generally not compatible with the protected and scheduled coastal areas:

Area 1

- Agricultural areas (Policy CG 24) awaiting classification;
- Listed areas / sites of scientific importance (Policy CG 22);
- Scheduled areas / sites + Special areas for conservation;
- Listed ecological areas / sites (Policy CG 22);
- Areas of High and Very High Landscape Sensitivity (Policy CG 22); and
- Protected natural coast with public access (CMLP Policy NA 04).

Area 3

- Site of Scientific Importance / Area of Ecological / Geological Importance;
- National park (Policy SMIA 13);
- Agricultural areas (Policy SMAG 01); and
- Public urban open space (Policy SMSE 04).

9.99 The construction of low-rise establishments and harvesting of surface runoff could, however, improve the impact of industrial and environmental infrastructure on the surrounding environment.

9.100 The afteruse development of the reclamation areas as desalinisation plants and wastewater treatment facilities is not justified. The current desalinisation plants currently operate below maximum capacity and the infrastructure is sufficient to cover future freshwater needs. Once the new wastewater treatment plant is built at Ta' Barkat, it will be possible to treat all of Malta's sewage prior to disposal into the sea.

10 Infrastructure Requirements

Introduction

10.1 The infrastructure requirements for any reclamation scheme will depend on the intended after-use. Malta is a developed country with good existing infrastructure. Depending on the intended after-use, it is likely that the costs relating to provision of infrastructure are a small proportion of the costs of the overall scheme, due to the high cost of creating reclaimed land. As such, it is considered unlikely that infrastructure requirements will have a large impact on the viability of the overall scheme.

Highway Connections

10.2 Since the election held in March 2008, highway works in Malta fall under the jurisdiction of the Minister for Communications and National Projects whose remit includes the coordination of road building and maintenance. Prior to the election, highway works were coordinated by the Ministry for Urban Development and Roads, which was set up in 2004 to address the need to upgrade Malta's road network and utilise the foreign funding available for this purpose to the maximum effect.

10.3 Any land reclamation scheme is likely to require a connection into the existing road network as well as a road network on the reclaimed land itself. The road network will require careful design to ensure that a good flow of traffic is achievable between all areas. Public transport systems should also be integrated into the design.

10.4 Creating a highway connection to the existing road infrastructure in Area 1 is reasonably straightforward, since the Coast Road (Highway 1 - a primary road) runs along the coast for the majority of Area 1. In Area 3, there are existing highway connections (tertiary road) to Xghajra and an existing secondary road to the Ricasoli peninsular, however, this is planned to be upgraded as part of the Smart City Malta development. At the southern end of Area 3, there are limited opportunities for connection into the existing highway network.

Potable Water

10.5 The Primary network, including associated assets such as valves, inspection chambers, pumping equipment and control systems will need to be designed to the standards required by the Malta Resources Authority Act (2000) which is regulated by the Malta Resources Authority.

10.6 The Water Services Corporation (WSC) of Malta is a public utility body normally responsible for the supply production and distribution of water in the Maltese Islands. Malta's water supply is produced using boreholes and pumping stations to harvest groundwater, along with four reverse osmosis desalination plants with a total nominal capacity of 100 000 m^3/day. WSC also manages the municipal water distribution network.

This network consists of approximately 2,000 km of pipework of varying materials and sizes and a further 1,700 km of service pipework connecting more than 200,000 premises to the network.

10.7 Food and Agriculture Organization of the United Nations (2006) note that WSC figures indicate that the consumption of water exclusively for domestic purposes was 142 litres/person/day in 2000/2001 and demand has not changed significantly since this time. This figure falls to 76 litres/person/day when losses and unaccounted for water are taken into account.

10.8 The figure calculated by the Food and Agriculture Organisation of the United Nations (2006) for tourist water demand was 149 litres/person/day. However, this official figure is much lower than that for other Mediterranean countries. The corresponding official figure for Spain is 440 litres/person/day (with a maximum of 880 litres/person/day at tourist resorts) and that for Cyprus is 465 litres/person/day. These figures are inclusive of distribution network losses and are reduced by about 300 litres/person/day when losses and unaccounted for water are taken into account.

10.9 There is an existing water main (150mm diameter) running along the inner edge of the Coast Road in Area 1 and a water main (150mm diameter) supplies Xghajra in Area 3. WSC have advised[41] that there is some spare capacity, so depending on the afteruse, a proposed reclamation scheme may be able to be served by existing water infrastructure. WSC advised that the Pembroke Reverse Osmosis Plant would need to be taken into consideration in any reclamation in Area 1.

Sewerage

10.10 If a reclaimed area is developed upon, the water used every day in homes, offices and other components of the development must be evacuated through the sewerage infrastructure. This wastewater must be collected and conveyed to treatment facilities, where liquids and solids are separated by different processes, to then be returned to the environment. Sewage treatment protects public health by destroying disease-causing organisms that may be in the wastewater. Treatment also safeguards water quality by preventing pollution in the receiving media, be it the sea receiving treated sewage effluent or landscaped areas irrigated by this effluent.

10.11 Adequate planning of the sewage collection and treatment systems is essential for the community to maintain adequate levels of sanitation and to minimise any adverse environmental impact. The magnitude of the development project deserves careful consideration of the expected volumes of sewage generated by the population and its activities, as well as the optimum systems for collection, treatment and disposal or re-use of the resulting sub-products.

10.12 There are two possible sewerage systems that are options for the new areas. One option

[41] Meeting with Water Services Corporation held 17 September 2007 at which Marc Muscat, Joseph Curmi, Stephen Galea St John and Kevin Morris were present.

would be a conventional gravity sewer and the other would be the less conventional vacuum/ pneumatic collection system.

10.13 WSC have advised that for a reclamation development in Area 1, the nearest sewerage main is at the end of the catchment for the southern STP at Bahar ic-Caghaq. Alternatively, the end of the catchment for the northern STP (Ic-Cumnija) is at the Coastline Hotel. However, WSC advised that there was limited additional capacity in the existing network after taking account of the additional loads arising from development projects such as those taking place in Sliema and St Paul's Bay. For a reclamation development in Area 3, WSC advised that a pumping station would need to be added on the reclamation.

10.14 WSC advised that given the capacity limitations in the existing system, it would be preferable for any reclamation scheme to be designed to be self-sufficient in terms of sewage treatment.

Power

10.15 If a reclaimed area is to be developed upon, it will be necessary to extend the present Maltese transmission system up to the project site in order to meet the development's power requirement. It is likely that the transmission system would be extended in a phased manner.

10.16 At present, Malta relies entirely on imported fossil fuels for energy generation as the country has no fossil-fuel resources. The total generating capacity currently stands at 571MW produced by two oil-fired power stations based at Marsa and Delimara which are run by the Enemata Corporation and connected to the national electricity grid.

11 Implementation

Programme and work plan

11.1 The programme for taking the land reclamation concept from the current status through to the first parcel of land becoming available for development is likely to be a minimum of 5 years, and may be much longer.

11.2 The programme can be considered to have the following phases:

- Feasibility;
- Detailed study, Environmental Impact Assessment (EIA) and planning;
- Procurement;
- Construction; and
- Maintenance and after-use.

Feasibility study

11.3 A full feasibility study would focus on one or two preferred locations for reclamation and fully explore the issues associated with reclamation at these sites. A programme of work would include:

- Geotechnical properties of the seabed at the sites, to ascertain suitability for the proposed works and engineering parameters such as bearing capacities, likely consolidation rates, and need for removal of any soft sediment layers. Marine geotechnical surveys have a high cost but are essential at a reasonably early stage of project development to ensure that conditions are suitable for the works envisaged. The scope of work is likely to include marine boreholes along the line of the edge protection breakwater plus use of seismic methods to establish sediment depths;
- Site survey, including both seabed levels and adjacent land topography. The marine survey would probably include measurement of currents and water levels and possibly wave heights and directions;
- Detailed evaluation of wave climate at sites to support an outline design of edge protection and a risk-based assessment of alternative construction approaches. Evaluation of wave climate is likely to include both desk-based methods and an element of site-specific field data collection;
- Preparation of a phasing plan identifying programme for each phase, to enable construction planning and to support the economic assessment;
- More detailed construction costings. In order to make costings as accurate as possible, both local and major international contractors would be consulted (without any commitment) to verify rates;

- Preparation of a conceptual master plan for the development, to support the assessment of economics for the development and the costing of infrastructure requirements;
- Detailed economic and financial assessment for the proposed sites, taking into account the project-specific phasing plan, nature of the sites, information on demand and land values at these locations and identifying whether the project is beneficial to the country and viable as an investment opportunity for others;
- Site-specific assessment and costing of infrastructure requirements;
- Assessment of alternative procurement and investment approaches, resolution of private/public ownership issues and identification of responsible authority to take project forward. This task encompasses all the investigations and decisions required to arrive at a robust approach to who will take responsibility for the project in government, how the project will be funded, how it will be delivered and how the land created will be developed and who it will be owned by. There are obviously some parallels to draw from in Malta, such as the Freeport and the Smart City Malta project. There are also models from international experience, such as the inert waste reclamation in Jersey, and the large reclamations in Dubai and, Bahrain. Each of these has a different approach;
- Review and resolution of issues related to ensuring material supply, in the context of other aspects of inert waste management and taxation regime, renewal of land filling contracts etc. In order for the project to be secure, the supply of Globigerina must be maintained which means the project must have some level of governmental 'protection' against adverse impacts which could arise from changes in legislation, licensing agreements or taxation policies;
- Site-specific baseline environmental surveys and outline EIA; and
- Preparation of a risk register, with identification of risk percentages, outturn impacts (on programme and costs) and mitigation measures.

11.4 The results from these studies would be a report setting out a site-specific assessment of the project, its costs, risks, economics, finances and environmental issues, sufficient to support a decision to take the project forward. The timescale for this phase would be about 12 months.

Detailed study, EIA and planning

11.5 This phase would take the project from feasibility to completion of designs and all planning requirements. It would include:

- Design of reclamation and edge protection, with full drawings and specifications. A client's preferred design would be produced, as a basis for costing, phasing and risk assessment. However, normally alternatives to this would be allowed providing that the alternatives meet the performance specifications;
- Design of infrastructure, with full drawings and specifications;

- Preparation of contract documents for a selected preferred procurement approach. This would involve a number of contracts, both for the construction phase and for the investment/ownership aspects, including responsibilities for maintenance, arrangements for land sales and post-construction ownership;
- An agreed master plan for the development;
- A full EIA or Environmental Statement (ES), to support a planning application. The EIA/ES would include proposals to monitor and mitigate impacts associated with construction such as traffic, noise, control of materials deposited into the water column, protection of habitats etc. For a project of this size it would almost certainly need to be accompanied by illustration media such as virtual images, fly-throughs, artist's impressions etc. and by a stakeholder engagement and consultation summary; and
- Including the planning process, this phase might take a further 12 to 24 months. At the end of the phase the responsible authority would have an implementable scheme.

Procurement

11.6 This phase, which would take a minimum of 12 months, would include the advertising, tendering and assessment process to put in place the appropriate combination of investor and construction entities.

Construction

11.7 The Construction phase can be further sub-divided into pre-construction activities and construction proper. Pre-construction activities would include:

- Construction of enabling facilities, such as haul routes, access roads, weighbridges, site compounds;
- Setting up of processing and production facilities such as pre-cast concrete production yards or caisson construction docks, concrete batching plants;
- Setting up waste sorting and processing facilities;
- Mobilisation of marine and land-based plant, and recruitment of staff and workforce; and
- Installation of site utilities, such as power, water, wastewater

11.8 Construction activities would include:

- Construction of edge protection ahead of the reclamation, probably by building a breakwater out form the land, armouring it against wave action as the length is extended to provide a calm area for placement in its shelter. Preparation of the sea-bed might be required;
- Placement of reclamation fill, probably by end tipping from a causeway, with

possible processing of the top layers to provide a stronger, more compact surface;

- Construction of infrastructure such as access roads and utilities on the reclamation itself; and
- Monitoring for environmental compliance including elements such as noise, traffic, water quality, ecology;

11.9 Construction could take many years, depending on the sale of project undertaken and the rate of supply of inert waste. For long-term projects there would need to be carefully planned approach to releasing reclaimed land as soon as possible in order to get the benefits of land creation as early as possible.

Maintenance and after-use

11.10 After construction, responsibility would transfer to the developing agency; sub-dividing the reclamation into appropriately size land parcels for development, putting in infrastructure to each plot and taking on the responsibility for maintenance.

11.11 Construction could take many years, depending on the sale of project undertaken and the rate of supply of inert waste. For long-term projects there would need to be carefully planned approach to releasing reclaimed land as soon as possible in order to get the benefits of land creation as early as possible.

PART C: ECONOMIC FEASIBILITY

12 Cost Estimates

Introduction

12.1 The purpose of this chapter is to present outline cost estimates for various elements required in the construction of any land reclamation scheme. Costs have been derived from a combination of discussions with Maltese experts in marine construction and from Scott Wilson's own experience on this type of project. Nonetheless, at this stage, there is a large degree of uncertainty in many of the cost estimates so these figures can only be considered indicative at this stage.

12.2 The cost estimates have been used in the economic analysis presented in Chapter 12.25.

12.3 The elements of the land reclamation for which costs have been estimated are listed below:

- Reclamation edge protection;
- Reclamation fill; and
- Infrastructure.

12.4 All land reclamation schemes in Malta will require some form of edge protection structure and fill in order to produce the reclaimed surface. Land reclamations which are to be developed, as opposed to those which will be used simply as repositories for inert waste, will require infrastructure. The type and extent of infrastructure required will vary depending on the after-use.

Reclamation Edge Protection

12.5 The need for an engineered structure to protect the reclamation is discussed in Chapter 7 describing construction principles for reclamation schemes. Chapter 7 also describes different edge protection structures. Indicative cost estimates have been produced for three possible edge protection structures.

12.6 Analysis of extreme waves carried out for Technical Report 1 indicates that the 1 in 100 year wave height occurring in Areas 1 and 3 is of the order of 5m (in a water depth of 20m). If a specific reclamation scheme were to be constructed, more detailed wave assessments would be required to specify the wave height to which the reclamation edge protection structure should be designed; this is likely to vary around the reclamation since some areas of the reclamation will be more exposed to wave attack than others.

12.7 The water depth varies along the perimeter of each of the twelve reclamation shapes described in Chapter 6. The length of reclamation structure has been calculated within water depths 0-1m, 1-2m, 2-3m etc, etc for each of the twelve reclamation shapes. For each type of reclamation edge protection structure, the cost of a unit length of structure was calculated in (up to four) different water depths. The cost per unit length of structure

in different water depths was then interpolated and combined with the information about water depth around the perimeter of each reclamation shape to produce a cost for the edge protection of each reclamation shape.

12.8 Cost estimates have been produced for three types of edge protection structure:

- Accropode units;
- Concrete caissons; and
- Steel cofferdams.

12.9 Each of these structure types have advantages and disadvantages and will be the optimum choice in a particular set of circumstances. In practice with very large marine projects of this type, the most cost-effective solution is often determined by the specialist plant available to potential contractors. The optimum choice will also be affected by any programme requirements – a more relaxed programme accommodates a wider variety of methods, whereas a tight programme would tend to lead to a single solution. Since at this stage, there is no specific reclamation scheme, it is not possible to specify which type of edge protection would be the optimum option. The mean edge protection cost (including accropode, concrete caisson and steel cofferdam edge protection costs) was calculated for each reclamation shape; this was the edge protection cost which was used in the economic analysis described in Chapter 12.25.

Accropode Units

12.10 Using design tables supplied by Concrete Layer Innovations (CLI) specifically for Accropode units, an outline design was produced for an edge protection structure constructed in a water depth of 5m, 10m, 15m and 20m as shown indicatively in Figures 12-1 to 12-4. The outer layer of the structure is composed of accropode units (of differing size in different water depths) with an underlayer assumed to be good quality rock. The core of the structure is assumed to be 50% good quality crushed rock and 50% reclaimed globigerina. This working assumption would need to be validated by further investigation during the design process.

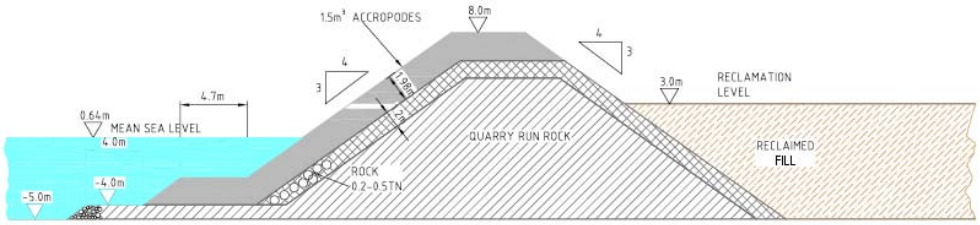

Figure 12-1: Indicative accropode edge protection structure (5m water depth)

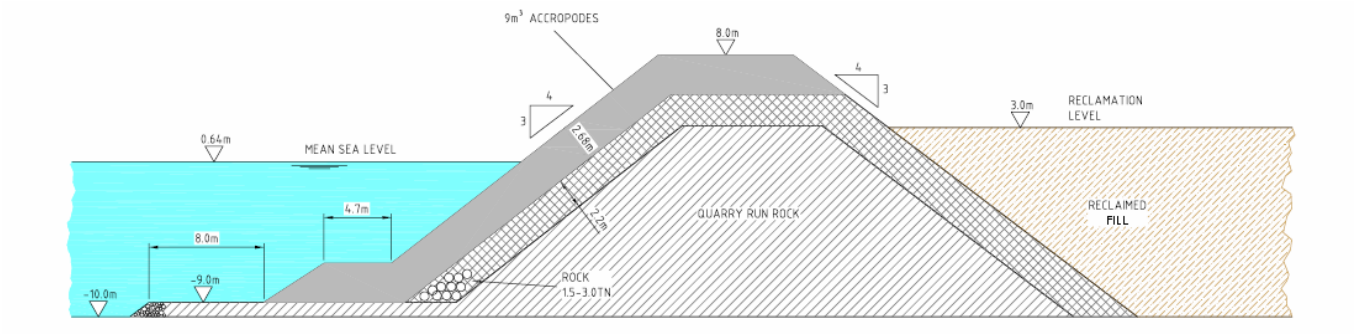

Figure 12-2: Indicative accropode edge protection structure (10m water depth)

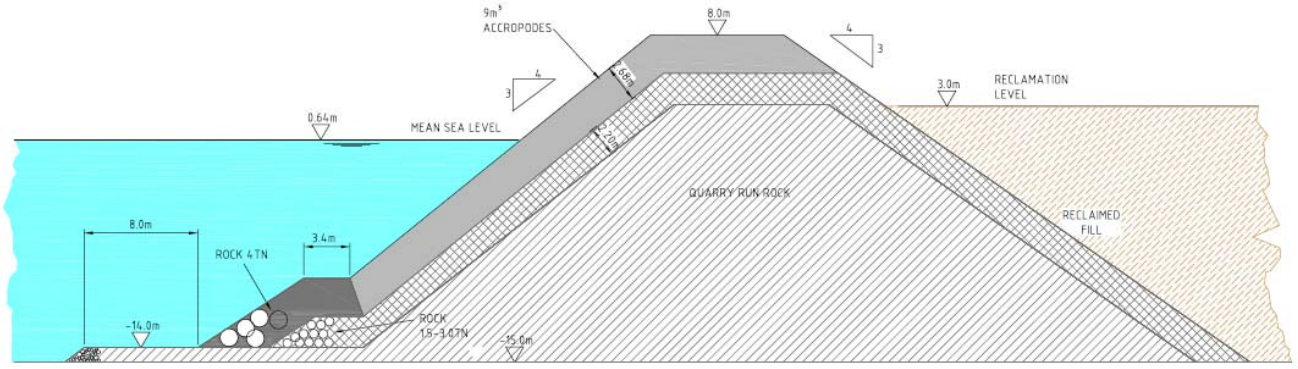

Figure 12-3: Indicative accropode edge protection structure (15m water depth)

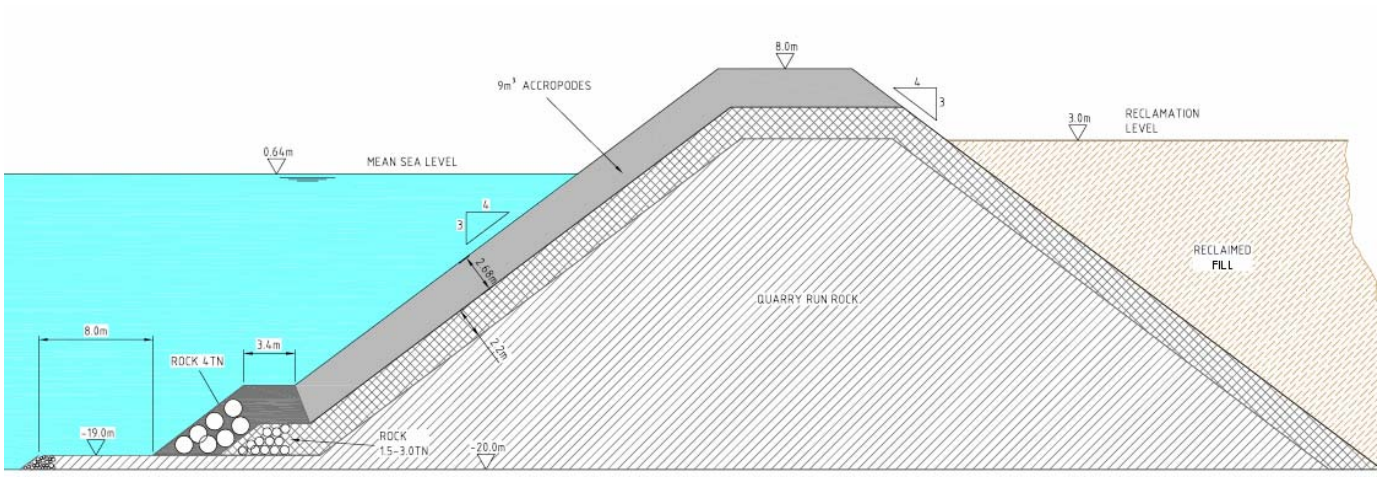

Figure 12-4: Indicative accropode edge protection structure (20m water depth)

12.11 Based on Scott Wilson's experience of maritime construction projects worldwide which have included accropode revetments, rates per unit volume were estimated for the

accropode units (of varying size), the underlayer and the structure core.

12.12 Using the unit rates described above and the outline design for an accropode edge protection structure in 5m, 10m, 15m and 20m water depth, the cost per linear metre of structure was calculated for each of the four outline designs. These costs per unit length were then interpolated and combined with information about the water depth around the perimeter of each of the twelve potential reclamation shapes in order to produce a cost for accropode edge protection for each of the reclamation shapes.

Concrete Caissons

12.13 Concrete caissons have been used successfully in Malta for a number of projects, including construction of the breakwater for Malta Freeport, as described in Chapter 5.

12.14 Based on experience with similar projects and advice from Joseph Sciortino, the cost of concrete caisson edge protection structures were derived for water depths of 5m, 10m, 15m and 20m. It was assumed that a minimum freeboard of 5m would be required and that four different caisson sizes would be used with heights of 10m, 15m, 20m and 25m. Based on previous experience, it is known that for stability reasons, the caisson width is required to be approximately equal to its height.

12.15 Based on experience of similar projects which have involved the use of caisson structures, a rate per unit volume of caisson was estimated (which included caisson construction, towing, filling and sealing). This was used to calculate a cost per linear metre of structure for caissons in water depths of 5m, 10m, 15m and 20m. These costs per unit length were then interpolated and combined with information about the water depth around the perimeter of each of the twelve potential reclamation shapes in order to produce a cost for concrete caisson edge protection for each of the reclamation shapes.

Steel Cofferdams

12.16 Steel cellular cofferdams were recently used successfully in the construction of the reclaimed area for Malta Freeport.

12.17 Cost estimates are based on information provided by Joe Bugeja of the cost per linear metre of installed quay wall for Malta Freeport (Phase 2). This was used to estimate the cost per linear metre of steel cellular cofferdams in water depths of 5m, 10m, 15m and 20m. As with the concrete caissons, it was assumed that a minimum freeboard of 5m would be required. These costs per unit length were then interpolated and combined with information about the water depth around the perimeter of each of the twelve potential reclamation shapes in order to produce a cost for steel cellular cofferdam edge protection for each of the reclamation shapes.

Reclamation Fill

12.18 Based on advice from Joe Bugeja and Joseph Sciortino, the cost of placement and compaction of the reclamation fill material is of the order of €9.3 – 11.6 per m^3. This

assumes placement of the fill is a land-based operation (using end-tipping trucks) with no specialist compaction techniques used.

12.19 If the reclamation fill were to be placed by barges (necessitating the construction of loading and unloading facilities and increased handling of the fill material) or if sophisticated sorting methods or an engineered compaction technique is employed (such as the vibro-compaction utilised for some areas of Malta Freeport), the cost of placement and compaction of the fill will increase.

Infrastructure

12.20 Based on Scott Wilson's experience of provision of services and infrastructure for a number of mixed-use development reclamation projects worldwide, a cost per m² of reclaimed land area has been estimated. This figure has been used to estimate the cost of infrastructure for each of the twelve reclamation shapes based on their plan area. A supplementary amount has been added for each of the reclamation shapes that form islands since there will be additional costs relating to the provision of undersea utilities connections which will apply to artificial islands and will not be required if the reclamation is an extension to the existing landmass.

12.21 The estimation of the cost of supplying infrastructure to the reclamation is the most uncertain element of the cost estimate, since the amount and type of infrastructure required will depend on the after-use of a particular reclamation scheme.

12.22 It should be noted that the infrastructure costs are intended to cover for the principal connection of the reclamation to the mainland and to provide a 'backbone' of service provision within the reclamation. The costs would not be sufficient to provide fully-serviced individual plots – these costs would be additional, along with costs of development such as buildings.

Summary of Estimated Costs

12.23 Table 12-1 summarises the principal costs for the twelve reclamation shapes, showing total area reclaimed, fill volume and cost of filling, length and cost of edge protection, infrastructure cost. As noted above, these figures should be regarded as preliminary, suitable for an initial assessment of the economic viability of the concept, and for establishing a benchmark figure for the level of investment required for projects of varying scale. If the land reclamation project is taken further then more detailed, site specific cost estimates will be required.

12.24 The costs in Table 12-1 also include preliminary costs, required to complete site investigations, designs, planning applications and any other preparatory work prior to commencement of construction.

Table 12-1: Summary of principal reclamation costs

Shape	Area (ha)	Fill Volume: million m^3	Fill Cost: Million €	Edge Protection: Length m	Edge Protection: Cost Million €	Infrastructure Cost: Million €	Preliminary Costs: Million €	Total Cost: Million €
1a	17	1.6	17	500	18	12	2	50
1b	29	5.0	53	2,000	151	44	10	258
1c	44	5.0	52	1,600	70	32	8	162
1d	49	5.0	52	2,200	96	35	9	192
1e	66	10.0	105	1,700	156	48	12	321
3a	49	5.0	52	5,200	183	35	11	281
3b	88	10.0	105	5,400	283	63	18	469
3c	144	20.0	210	5,600	575	103	22	911
3d	33	5.0	52	1,600	164	24	10	250
3e	63	10.0	105	2,600	273	45	17	439
3f	127	20.0	210	4,700	540	91	21	862
3g	25	4.7	49	2,200	272	41	15	377

12.25 It is clear from Table 12-1 that the two island shapes (1b and 3g) are significantly more expensive overall in comparison with the land-extension shapes (when comparing shapes 'absorbing' the same volume of fill). Shape 3g is in deeper water than Shape 1b and as a result, edge protection and overall costs are higher. As discussed during the stakeholder workshop, there are significant technical difficulties relating to the location of shape 3g on top of a disused spoil ground. It would not be possible to construct edge protection structures on top of unstable dumped material which could include ordnance. By inspection, Shape 3g is economically less advantageous than Shape 1b (higher overall cost combined with smaller reclaimed area produced and less fill material accommodated)

and also poses significantly greater technical challenges than the remainder of the reclamation shapes. As a result, Shape 3g has not been analysed as part of the economic assessment presented in Chapter 13.

13 Financial & Economic Evaluation

Introduction

13.1 This chapter presents an economic feasibility study for various land reclamation options being considered for implementation in Malta. Land reclamation may be viewed as a waste management activity, mainly in relation to inert excavation waste, as well as creating land surface area for potential economic use.

13.2 This report takes into consideration eleven indicative land reclamation shapes which were generated to facilitate assessment of reclamation on and off the east coast of Malta. These are labelled 1a through 1e and 3a through 3f. The shapes are not mutually exclusive – each is one particular approach which might be taken to land reclamation, and these shapes include in some cases a degree of overlap – for example shape 3b encompasses all of shape 3a. Nonetheless each shape has been assessed individually to give an initial overall assessment of economic viability.

13.3 The capacity of each shape to accommodate inert waste varies from 1.6 to 20 million m^3.

13.4 From the perspective of the creation of land area, the individual options considered would generate between 170,000 and 1,442,000 square metres[42].

13.5 The economic feasibility study presented in this report follows two approaches. The waste management approach focuses on the cost of utilising land reclamation to absorb inert waste and compares it to the absorption capacity and costs of other alternatives. The creation of economic value approach compares the costs of developing land through reclamation activity with the potential economic benefits which such land could generate. For this purpose, it is assumed that the land would be utilised towards projects with high value added activities similar to the SmartCity Malta concept already being developed in Malta. Indications of net economic values from the perspectives of private and social economic returns to land reclamation are provided. In each case, multiplier effects on economic activity arising out of the creation of the land reclamation infrastructure and filling activities are also considered.

13.6 This study provides indications of economic feasibility without taking into consideration other constraints to the undertaking of land reclamation and the development of land thus created. In particular, environmental and policy constraints are assumed not to impinge on economic valuations.

Land Reclamation as a Waste Management Option

13.7 The assessment of land reclamation from a waste management perspective is undertaken on the basis of comparison of costs of different options, on the premise that the benefits

[42] This applies to a filling up to a level of 5 metres above sea level. No useable land area is presumed to be created by a fill level of 25 metres above sea level.

ensuing from each would be identical, namely the effective management of inert waste. In this context, the eleven land reclamation shapes considered here are to be compared not only between themselves but also with alternative approaches to the management of inert waste.

13.8 These include landfilling in quarries and dumping at sea, both of which are already being undertaken in Malta and which can be expected to continue in the near term. However, whereas landfilling in quarries has a limited capacity for waste absorption, estimated at around 8.4 million cubic metres of waste[43], dumping at sea is viewed to potentially be an unlimited source of absorption of such waste. It is to be observed that the potential for creation of economic resources through both these approaches is deemed to be irrelevant to this study[44].

13.9 An alterative option is to reduce the creation of inert waste mainly through conducting excavation works in a manner which quarries large blocks with potential use. While this option is technologically feasible, there exists to date no market for such large blocks in Malta, except perhaps to be used for land reclamation itself. Yet another approach is to utilise inert waste for the production of construction materials. There is a stable demand for this activity, which is already under way and can be expected to continue in the future, absorbing 0.7 to 1.0 million cubic metres of waste per year (see Chapter xx). As such, this activity can be viewed to operate independently of the need to identify and evaluate management options for inert waste, and is therefore considered to be not relevant to this study. In other words, this study focuses on the management of inert waste that is not recycled, as recycling activities are viewed to not depend upon decisions regarding land reclamation.

13.10 Table 13-1 details the costs per cubic metre of waste associated with the eleven land reclamation shapes considered in this study and in comparison with the options of landfilling in quarries, dumping at sea and reducing the volume of inert waste generation.

13.11 The results indicate that the cheapest option is landfilling in quarries, with a cost of €3.4 per cubic metre of waste. This is the price paid by generators of waste to dump inert waste in quarries and is inclusive of the operational costs as well as an environmental tax element. It is however to be considered that this option presents a relatively limited capacity, amounting to a total of 8.4 million cubic metres of waste, roughly equivalent to four years of generation of inert waste that is not recycled.

13.12 The second cheapest option is dumping of inert waste at sea. This entails a cost of €4.2 euros per cubic meter of waste generated, inclusive of transport cost and environmental taxation. The capacity of this type of inert waste disposal is considered to be virtually unlimited.

[43] Malta Environment and Planning Authority, (2007). *op cit*.
[44] Dumping in quarries would not create a surface area that is additional or of higher value to that already available inside the quarry. The potential for dumping at sea activities to create artificial reefs has not been sufficiently explored to determine actual feasibility.

Table 13-1: Waste management perspective – an analysis of costs

Inert Waste Disposal Options		Volume (million m^3)		Present value of costs per Cubic Metre (€)	
		Fill up to 5m	Fill up to 25m	Fill up to 5m	Fill up to 25m
Land Reclamation	1a	1.6	4.7	19.6	11.4
	1b	5.0	10.3	39.6	27.6
	1c	5.0	12.9	25.0	11.9
	1d	5.0	13.8	23.8	11.8
	1e	10.0	21.9	15.4	9.4
	3a	5.0	13.8	32.6	14.6
	3b	10.0	25.8	26.0	12.2
	3c	20.0	45.9	24.7	13.0
	3d	5.0	10.9	35.3	19.0
	3e	10.0	21.3	26.6	14.5
	3f	20.0	42.9	23.9	13.7
Landfilling in Quarries		8.4		3.4	
Dumping at Sea		Indefinite		4.2	
Reduce		n/a		52.4	

13.13 Land reclamation entails costs per cubic metre of inert waste disposal ranging between €15 and €40, for the case where filling takes place to +5m. This in inclusive of the cost of studies, investigations, edge protection works, and the costs of placement itself, with costs brought to present value using a discount rate of 5 per cent[45]. This was undertaken because of the fact that each of the land reclamation shapes takes a number of years to complete, ranging from five to 27.

13.14 From the case where filling takes place to +25m the costs per cubic metre of inert waste disposal range between €9 and €28. Filling up to 25 metres above sea level is more cost efficient per cubic metre of waste dumped than those involving a fill of five metres above sea level. This is because the filling from +5 to +25 involves little or no extra expenditure on protective structures, studies etc.

13.15 A relevant content of this information for the purposes of decision-making is that land reclamation is in general more expensive than other feasible methods of inert waste disposal, particularly dumping at sea. Assuming that land reclamation is nevertheless to be pursued as an inert waste management activity, a useful indicator is a ranking of the relative cost effectiveness of the different options.

[45] Detailed cost estimates of the land reclamation options analysed here are presented in Chapter 12

Table 13-2: Efficiency rankings of land reclamation options

Inert Waste Disposal Options		Efficiency Rank	
		Fill up to 5m	Fill up to 25m
Land Reclamation	1a	12	2
	1b	22	19
	1c	16	4
	1d	13	3
	1e	10	1
	3a	20	9
	3b	17	5
	3c	15	6
	3d	21	11
	3e	18	8
	3f	14	7

13.16 The ranking by cost effectiveness, as indicated by the present value of costs per square metre of material accepted under each option, is provided in Table 13-2. Options 1a and 1e score highly in terms of cost effectiveness, whereas 1b is the least cost effective option. The prime reason for the variation in cost effectiveness is the variation in length of edge protection required and the depth of water in which it is located. Longer, deeper breakwaters add to costs and make options less cost effective. Option 1b, the offshore island, has along breakwater because it must protect the entire circumference of the island and it ids located in relatively deep water. Conversely Option 1a has a very short breakwater length in a shallow location.

The Creation of Land with an Economic Value

13.17 Land reclamation options with a fill level of around five metres above sea level can create land area with a potential economic value. The area to be created is of an environmentally sensitive nature and can thus be expected to be permitted for development only for projects with a relatively high value added, which are essential to the national interest. For this reason, it is here assumed that the only type of economic development which will be permitted in land reclamation zones would be similar to the SmartCity Malta project currently under way in Malta.

13.18 The SmartCity Malta project is a self-contained development catering for ICT- and media-oriented activities based on an international hubbing concept, together with commercial, mainly hotel activities as well as a residential area, including public spaces. It is expected to entail an investment of €233 million over a period of five years and generate employment of around 5,600 persons over a period of seven years. It will occupy an area of over 356,000 square metres of which just under 118,000 square metres will be public space.

13.19 The economic benefits arising from land reclamation can thus be construed as the economic value added, measured in terms of gross wages and profits, which can be generated in the Maltese economy by the utilisation of the available land for development similar to the SmartCity project. Towards this end, the net economic value added generated by the SmartCity project was estimated and expressed in terms of benefits per square metre which would then be applied to the land areas which become available through the land reclamation options considered here. It is thereby being assumed that the areas obtained through land reclamation would feature development which is similar in composition and economic effects to that of the SmartCity project.

13.20 This approach thus adopted a social net benefit viewpoint of the land reclamation options considered in this study, including not only the profits of private sector developers and eventual users of the land but also the wages being earned and the subsequent multiplier effects accruing to the rest of the economy. This approach is *per se* justifiable, and is further warranted by the fact that the investment in land reclamation is of a significant amount and would be likely to be undertaken as a national project similar to the case of SmartCity.

13.21 The estimation of the net value added to be obtained through the SmartCity project, inclusive of second round and multiplier effects was derived through an econometric model of the Maltese economy. The model was estimated using quarterly data for GDP and its expenditure components for a time series sample between 2000 and 2006, and was based on the error-correction dynamic specification. Among its exogenous inputs, there were expenditure on investment, which is represented by the investment expenditure expected to be undertaken in SmartCity and which was assumed to take place in a uniform manner over a five-year period. The model also included as an exogenous input, the increase in the economy's potential output, which was represented by an estimate of output generated by new employment in the ICT and hospitality activities encompassed by the project, which was assumed to increase in a uniform manner over a seven year period.

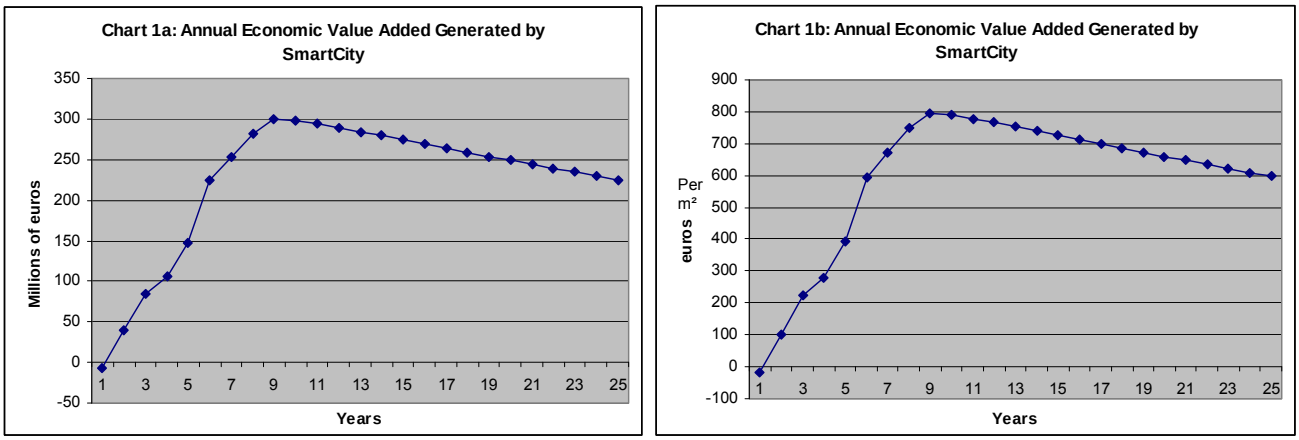

Figure 13-1: Economic benefits from Smart City Malta

13.22 The principal effects captured by the model are as follows. The investment expenditure on the development of the SmartCity infrastructure creates wages and profits for the operators involved, which in turn results in further consumption and investment rounds, leading to multiplier effects on the economy. Another important effect relates to the operational phase of SmartCity, where the generation of employment would be reflecting the creation of output, and hence wages, profits and further consumption and investment rounds in the economy.

13.23 The results of this exercise are shown in Charts 1a and 1b (in Figure 13-1), which illustrate the economic benefits estimated to accrue from the SmartCity project over a 25-year horizon, in total and per square metre of development respectively. As Chart 1a shows, the net annual economic benefits from the project start at a negative level in the first year, when expenditure is expected to exceed output, continue at relatively low levels in the first few years of operation to eventually peak at around €300 million by the ninth year of operation. The gradual trend decline in benefits up to year 25 reflects the effects of capital depreciation, as the possibilities of reinvestment are not considered in this simulation. Chart 1b shows a similar pattern of development in terms of benefits per square metre of land, with a peak of €800 being reached in the ninth year of operation.

13.24 The values shown in Chart 1b were then multiplied by the square metres of land obtained under each land reclamation option to obtain the potential aggregate economic benefits in each case. The streams of annual benefits for each option were then expressed as present values using a discount rate of 5%. The land areas, and present values of costs and benefits for each of the eleven land reclamation options are summarised in Table 13-3. A quite conservative approach has been adopted, whereby it is assumed that the development benefits do not come on stream until the end of the full reclamation construction period.

13.25 The table indicates that land areas from the options being considered vary from 170,300 square metres to 1,441,500 square metres, with the present value of land reclamation costs varying between €42.3 million and €546.8 million. In spite of the fact that land reclamation costs depend on various considerations which need not necessarily be associated with land area produced, there is a strong, 0.93 degree of correlation between the present value of land reclamation costs and resulting land surface area.

13.26 On the basis of land reclamation costs and estimated benefits from development, all eleven land reclamation options produce significantly positive net economic benefits, with internal rates of return ranging from a high of almost 40% in the case of option 1a to a low of 9.5% for option 3f. These levels of internal rates of return would not be perturbed by the undertaking of sensitivity analyses, save for those related to options 3c and 3f. These are the largest of the projects, and not only entail lower rates of return but also higher risks. Each of them has an area that is three to four times that of SmartCity and there could be issues of insufficient demand to fulfil the projected benefits associated with economic activity under these options.

13.27 Some analytical relationships explaining the findings in relation to the results of the cost-benefit analysis are shown in Chart 2a through 2d in Figure 13-2. Chart 2a indicates that

the higher internal rates of return are associated with options involving present values of lower costs per square metre of land obtained. The higher internal rates of return are also associated with the options which overall feature a lower area size, as shown in Chart 2b. This is in spite of the fact that there appears to be only a weak association between the costs per square metre and area size (Chart 2c). It is however true that options with smaller area sizes tend to have higher net present value of benefits per square metre, mainly due to the timing of benefits which would start to accrue earlier in the smaller reclamation options.

13.28 The foregoing analysis presented an economic feasibility assessment from a social perspective based on the assumption that in the national interest, a development of relatively high economic value would be undertaken in the reclaimed areas. This resulted in high values of internal rates of return for most of the options considered, as shown in Table 13-3. These values, and consequently, the economic feasibility, would of course be lower if the development undertaken on reclaimed land would be of a lower value added type compared to the SmartCity model, such as industrial or port use, or passive recreation.

Table 13-3: Summary cost-benefit analyses of land reclamation options – social perspective

Land Reclamation Options	Area (m^2)	Present values per m^3 (€ millions)			Internal Rate of Return	
		Land Reclamation Costs	Development Benefits	Net Benefits	Amount	Ranking
1a	170,300	42.3	616.7	574.3	39.9%	1
1b	291,700	229.4	1,243.1	1,013.7	19.8%	9
1c	439,200	149.7	1,871.7	1,722.0	26.5%	5
1d	487,300	145.8	2,076.7	1,930.8	27.7%	3
1e	662,800	185.7	2,660.2	2,474.5	28.0%	2
3a	490,200	187.4	1,967.5	1,780.1	26.5%	4
3b	875,600	300.1	3,180.0	2,879.9	24.3%	6
3c	1,441,500	546.8	2,259.8	1,712.9	10.7%	10
3d	331,900	194.6	1,414.4	1,219.8	21.2%	8
3e	626,900	295.6	2,333.1	2,037.5	21.2%	7
3f	1,270,500	525.9	1,991.7	1,465.8	9.5%	11

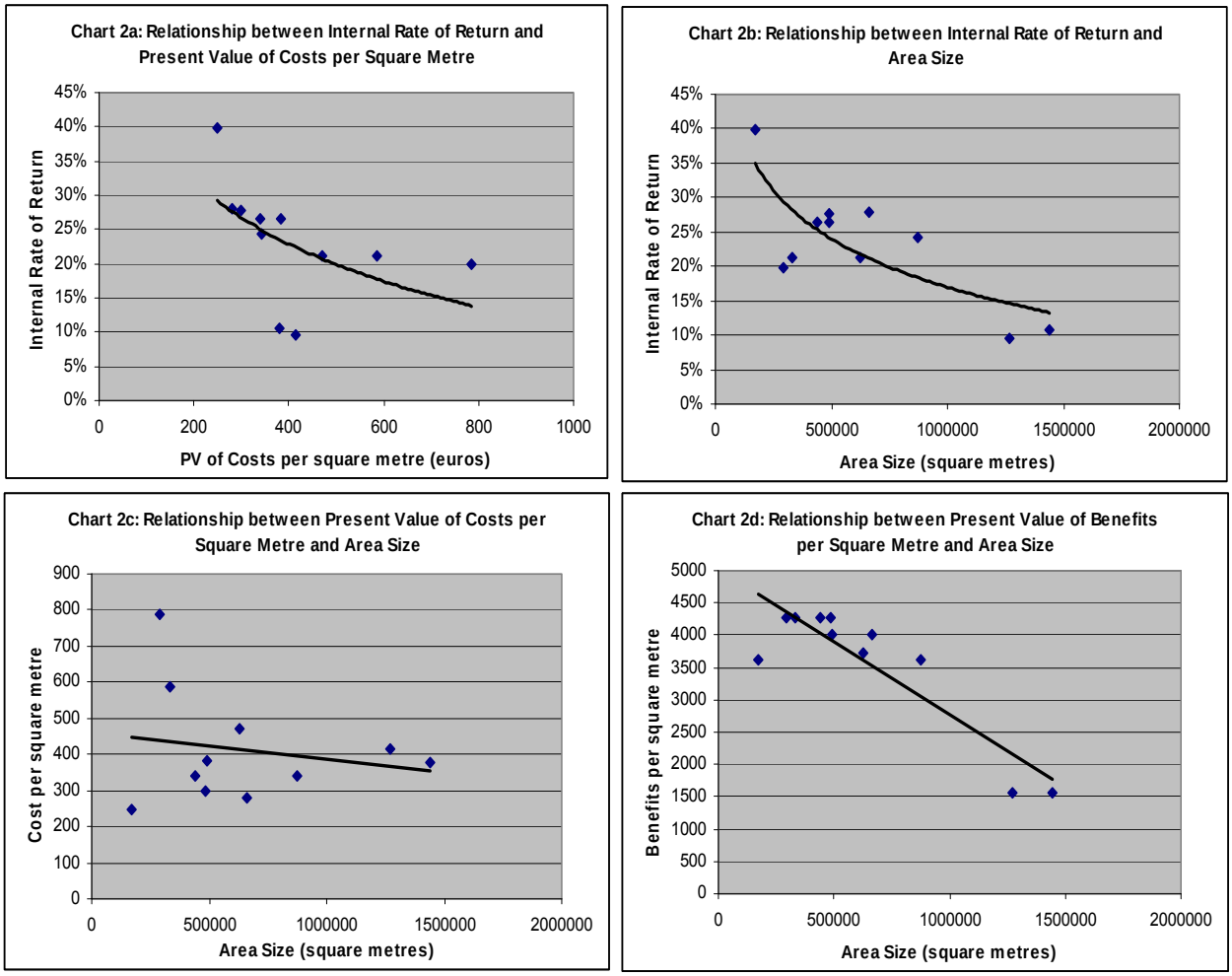

Figure 13-2: Results of cost-benefit analysis

13.29 A narrower view of the economic value of land produced by reclamation activities can be obtained by comparing the present value of the costs involved per square metre of land generated with the typical market value of land in Malta. This would entail a cost-benefit analysis restricted to the private sector developer viewpoint of reclaimed land, wherein the developer would be comparing the costs involved in this activity with the market prices which such land could attain.

13.30 This type of analysis is shown in Table 13-4, which compares, for each land reclamation option, the present value of the land reclamation costs with the present value of the capital value of the land obtained at the end of the reclamation process. In order to derive the latter, it is assumed that the average price of square metre of land is €1,600 euros, which is the lower value for land available for development in Malta and that 33% of the land would not be developed but left as public space. A discount rate of 15% is used to represent the higher returns sought in the private sector.

Table 13-4: Summary cost-benefit analyses of land reclamation options – private developer perspective

Land Reclamation Options	Area (m^2)	Present value (€ millions)		Capital Value to Reclamation Costs		Internal Rate of Return
		Land Reclamation Costs	Capital Value of Land Reclaimed	Amount	Ranking	
1a	170,300	28.2	70.0	2.5	1	51%
1b	291,700	129.1	59.6	0.5	10	1%
1c	439,200	84.6	113.1	1.3	4	23%
1d	487,300	81.9	125.5	1.5	2	26%
1e	662,800	90.5	129.0	1.4	3	24%
3a	490,200	85.1	95.4	1.1	5	18%
3b	875,600	129.9	121.2	0.9	6	14%
3c	1,441,500	229.0	118.5	0.5	9	6%
3d	331,900	117.6	67.8	0.6	8	6%
3e	626,900	140.3	83.3	0.6	7	7%
3f	1,270,500	226.7	104.4	0.5	11	5%

13.31 The results of this analysis show land reclamation shapes1a, 1c, 1d, 1e, 3a and 3b to be profitable from the private sector developer. Shapes 1a, 1c, 1d, and 1e present capital values to reclamation costs ratios ranging between 1.3 and 2.5, and therefore their profitability would be unlikely to be perturbed by sensitivity analysis. Shape 3a is marginal at a ratio of 1.1 and shape 3b with a ratio of 0.9 and an IRR of 14% is also marginal. The remainder fall below IRR of 10% and therefore are unlikely to be viable in the private sector.

13.32 In general the rate of return is maximised by the creation of the largest surface area for each cubic metre of fill and for each metre of breakwater, as long as the breakwater is in as shallow as water as possible. This is borne out by the lack of viability in private sector terms for the offshore island shape of 1b, which is located in deeper water with a long breakwater and conversely by the high viability of shapes 1c, 1d and 1e which are all located in relatively wide, shallow waters.

13.33 In general terms, the critical risks inherent in this analysis relate mainly to the policy constraints in relation to the use of reclaimed land for high value added economic projects. Risks to demand could be relevant only to the relatively large land reclamation options, and in case that several options would be undertaken simultaneously. In order to mitigate these risks, it is recommended that land reclamation would be undertaken as an integral part of a well-defined development project such that the policy constraints and demand risks can be more precisely assessed and evaluated.

Multiplier Effects from Land Reclamation Operations

13.34 Land reclamation activities, viewed as a waste management option as well as in the creation of land with an economic value, can be considered to have multiplier effects on the economy associated with the creation of infrastructure and filling operations. Such effects would materialise only on the assumption that land reclamation activities would utilise resources which would have been otherwise unemployed. If land reclamation were to crowd out other economic activities, particularly in the construction sector, the multiplier effects would not be a relevant consideration, as these would be already taking place.

13.35 Therefore, whereas the previous section evaluated the economic impact of the use of the potential use of the land created through land reclamation activity, this section assesses the economic value added generated by the creation of the land itself. This arises from the fact that expenditure on land reclamation activity would create wages and profits for the operators involved, which result in further consumption and investment rounds in the economy, leading to the creation of further value added. These effects, if relevant, would occur irrespective of whether the land created has any further economic use.

13.36 The multiplier effects of each of the eleven land reclamation options considered in this study were evaluated using the macroeconomic model of the Maltese economy referred to earlier on. This was done by considering the cost of undertaking land reclamation as construction investment spread over the time period of the activity. This was input into the model to obtain the relative effects on value added arising out of the generation of wages and profits from the undertaking of land reclamation leading to further consumption and investment rounds. As multiplier effects are dynamic and would tend to continue beyond the period of the original expenditure, the resulting increase in economic value added from the original investment expenditure was expressed in present value terms, using a discount rate of 5%.

13.37 The results of this exercise are summarised in Table 13-5, which detail the present value of construction costs and of the generation of value added which happens as a result of this, inclusive of the effects of further consumption and investment rounds. The multiplier effect is derived as the ratio of value added to construction costs.

Table 13-5: Multiplier effects of land reclamation options

Inert Waste Disposal		Present Values (€M)		Multiplier Effect	Duration of activity (years)
		Construction Costs	Value Added Generated		
Land Reclamation	1a	42.3	38.7	0.91	5
	1b	229.4	344.8	1.50	10
	1c	149.7	229.9	1.54	10
	1d	145.8	221.3	1.52	10
	1e	185.7	285.6	1.54	12
	3a	187.4	252.9	1.35	12
	3b	300.1	629.9	2.10	17
	3c	546.8	1575.0	2.88	27
	3d	194.6	331.3	1.70	10
	3e	295.6	675.9	2.29	17
	3f	525.9	1551.5	2.95	27

13.38 The value of the short-run multiplier in the Maltese economy tends to be relatively small and indeed lower than one. This is because of the high import content in the expenditure effected in the Maltese economy, arising out of its smallness and lack of resources, leading to an inherent openness. This explains the relatively low multiplier effect of option 1a, where the value added generated through the construction activity is 91% of the expenditure, including import content, undertaken.

13.39 On the other hand, it can be noted that the multiplier effects arising out of activities with a longer time span for completion are significantly higher. This is because the longer time horizon over which expenditure would be effected would enable the creation of further productive capacity to service the consumption and investment expenditure rounds which are created and which can be envisaged to be relatively long-lasting. Thus, the options which involve expenditure over a 10 to 12 year period feature multiplier effects of around 1.5, while those which have a time horizon in excess of 16 years involve multiplier effects of between 2 and 3. It is to be noted that the precise value of the multiplier effects would in this case be affected not only by the duration of the project but also by the timing of expenditure, due to the discounting effects.

13.40 The general conclusion is that the longer lasting projects would tend to have stronger multiplier effects may be contradicted by the fact that such projects are also the larger ones, and would possibly crowd out other activities in the economy, thereby tempering multiplier effects. This would of course be obviated if specific productive resources, including human and physical capital, are imported in order to undertake the land reclamation projects.

Conclusions

13.41 This chapter presented a study on the economic feasibility for eleven indicative land reclamation shapes. For the purpose of establishing costs and running the economic

model, land reclamation was viewed as a waste management activity, mainly in relation to inert (construction and demolition) waste, as well as to potentially create land surface area for economic use. Under both scenarios, the undertaking of land reclamation could have multiplier effects on the value added generated by the Maltese economy.

13.42 From the perspective of waste management, land reclamation appears to be inferior, from the economic viewpoint based on cost and capacity, to dumping at sea. If land reclamation is to be pursued as a waste management activity, options involving fills up to 25 metres above sea level tend to be more cost effective. The cost effectiveness approach presented in this report allows for a ranking of the relative attractiveness and possible sequencing of the land reclamation options being considered.

13.43 On the assumption that land obtained through land reclamation would be available for economic development, there appear to be the potential for strong net economic benefits to be reaped. This is due to relatively high land values in Malta, as well as the potential to undertake high value added investment projects in the economy.

13.44 However, in the case of the larger land reclamation options i.e.3c and 3f, the economic rates of return tend to be lower and the possible risks associated with demand would be higher. Such risks could also be more relevant in the case of the undertaking of several land reclamation options simultaneously. In order to mitigate these risks, it is recommended that land reclamation would be undertaken as an integral part of a well-defined development project such that the policy constraints and demand risk can be more precisely assessed and evaluated.

13.45 On the assumption that land reclamation projects do not crowd out other activities, particularly in the construction sector, the undertaking of the projects would be expected to create multiplier effects on the generation of value added in the Maltese economy. These effects would tend to be stronger for land reclamation options with a longer time horizon for completion.

13.46 Putting aside the issue of duration of projects, could in practice be adjusted to suit the rate of production of inert waste material, the shapes have been assessed against a number of criteria which are in essence affected by the physical nature of the location of the reclamation shape. Taking the rankings of four criteria as shown in Table 13-6 together, shapes 1a, 1e, 1d and 1c tend to give the best relative economic performance. Shape 1b, the island, consistently gives the worst relative performance. Area 1 performs better than Area 3 both in terms of cost effectiveness of waste management and in terms of development value. Within Area 3 the best performing options are 3a, 3b and 3c – the long, narrow shapes.

Table 13-6: Comparison of ranking of land reclamation shapes

Shape	Ranking on basis of cost per m3 at +5, without development	Ranking on basis of cost per m3 at +25, without development	Ranking on basis of internal rate of return as a public sector project with development	Ranking on basis of internal rate of return as a private sector project without development, but with land having development value
1a	2	2	1	1
1b	11	11	9	11
1c	6	4	5	4
1d	3	3	3	2
1e	1	1	2	3
3a	9	9	4	5
3b	7	5	6	6
3c	5	6	10	8
3d	10	10	8	8
3e	8	8	7	7
3f	4	7	11	10

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PART D: ENVIRONMENTAL FEASIBILITY

14 Environmental Policy & Legislation

Introduction

14.1 This Chapter describes the international and national legislation and policy that may be relevant to the land reclamation projects proposed in Areas 1 and 3. The discussion focuses on the relevant international legislation and local policies in particular:

- The definition of "waste" and "dumping";
- The planning context;
- Environmental legislation and the implications of reclamation on *Posidonia oceanica* beds;
- Legislative processes and procedures including consequences of breach of international protocols, EU, and domestic legislation; and
- Summaries and conclusions, including a list of immediate amendments to policy and law that would be necessary in order for the surplus material to be used for land formation in Areas 1 and 3.

14.2 Annex C of the Appendices contains a detailed discussion of the relevant legislation. This Paper draws upon and further discusses the legislative requirements contained in the Annex C.

Definition of "Waste" and "Dumping"

14.3 The international and national legal regime addressing pollution control targets its sources. One of the main sources of pollution is considered to be dumping at sea.

14.4 The 1982 United Nations Convention on the Law of the Sea (UNCLOS) requires coastal states to take measures, "*to minimize to the fullest extent,*"[46] pollution from dumping,[47] to prevent, reduce, and control pollution from the use of technologies under their jurisdiction or control,[48] and to protect and preserve rare or fragile ecosystems.[49] In so doing, coastal states have a duty not to transfer damage or hazards from one area to another or to transform one type of pollution into another.[50] Article 208 under this Part of UNCLOS specifically refers to the obligations of States to adopt national laws and regulations to prevent, reduce and control pollution from sea bed activities subject to their jurisdiction[51], or from dumping[52], which laws cannot be less stringent than international rules, standards, and recommended practices and procedures. This means that Malta should have specific

[46] Vide UNCLOS article 194 (3).
[47] Ibid para 3(a).
[48] Ibid Article 196.
[49] Ibid Article 194 (5).
[50] Ibid article 195.
[51] Ibid Article 208.
[52] Ibid Article 210.

legislation regulating activities and operations on the seabed and subsoil including the dumping of material on it in accordance with the 1996 Protocol to the London Dumping Convention or/and the Dumping Protocol to the Barcelona Convention,

14.5 The London Dumping Convention and its Protocol and the Barcelona Convention and its Protocol are the international legal instruments that address dumping at sea. Malta is a party to the London Dumping Convention but not to its Protocol. Malta's international obligations in this respect, therefore, are limited to those found under the London Dumping Convention and the Dumping Protocol of the Barcelona Convention to which it became a Party. Any reference to the Protocol under the London Dumping Convention is not legally binding upon Malta.

14.6 The London Dumping Convention and its Protocol exempt the "*placement of matter for a purpose*", if carried out in accordance with these legal agreements, from the definition of dumping at sea. To determine whether land reclamation operations can be classified, as "*placement of matter for a purpose*" requires an analysis of the definition of dumping at sea. The material used for land reclamation must be assessed to see whether it is classified as waste. If it is classified as waste then it is highly likely that land reclamation would not be considered as placement of matter for a purpose. If it is not classified as waste, the deposit of such matter cannot be regulated as a waste management operation and would be considered as placement of matter for a purpose. This does not mean that the placement of such matter would be unregulated and that it would be exempt from the measures to prevent and abate pollution, but simply that it would be not be considered to constitute dumping of waste at sea.

14.7 The Barcelona Convention obliges contracting parties, "*to take all appropriate measures to prevent, abate and to the fullest possible extent eliminate pollution of the Mediterranean Sea Area caused by dumping from ships*."[53] Its Dumping Protocol expands upon this obligation. The Protocol is known as the Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea; Malta is bound to observe this Protocol. The basic obligation of the Protocol[54] declares that the contracting parties shall, "*prevent, abate, and eliminate to the fullest extent possible pollution of the Mediterranean Sea, caused by dumping from ships and aircraft and incineration at sea*". As discussed above, the most relevant provision of the Protocol in respect of land reclamation is the article that lays down that dumping does not include, "*the placement of matter for a purpose, other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Protocol*".

14.8 Land reclamation operations do not constitute dumping, if three conditions are met:

- Placement of matter is for a purpose, other than mere disposal;
- The matter placed is not prohibited under Annex I55 of the Protocol; and

[53] Vide Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, as revised in Barcelona, Spain on 10 June 1995.
[54] Ibid Article 1.
[55]The Convention includes a three-part classification of substances with regulations governing the disposal of materials in each category. These are: Annex I – the "black list" (substances that are absolutely prohibited and should be released into the

- Measures are taken to prevent, abate, and eliminate pollution resulting from such placement.

14.9 The International Maritime Organization's (IMO) policy guidelines on the meaning of "*placement,"* formulated at the Consultative Meeting of the London Dumping Convention Contracting Parties, held in November 2004 list the following elements:[56]

- Placement should not be used as an excuse for disposal at sea of waste materials;
- Placement should not be contrary to the London Dumping Convention;
- Information on placement should be provided by the contracting Parties of the London Dumping Convention to the Secretariat; and
- Materials for placement should be assessed in accordance with relevant waste specific guidelines.

14.10 Land reclamation as described in this report constitutes "*placement for a purpose"* and not dumping because the aim of the reclamation is not to dump waste material but to create land with an economic value; land that can be developed. Land reclamation operations would therefore not be subject to a permit for dumping of wastes at sea as required by the Protocol.

14.11 While international conventions and protocols would classify land reclamation as placement for a purpose, national legislation must also be considered. A consideration is whether the matter for placement falls under the definition of waste found under the Waste Management (Permit and Control) Regulations (LN 337/2001), which transpose the Waste Framework Directive.

14.12 The Environment Protection Act, 2001 defines waste as follows: 'waste' means any thing, substance or object which the holder discards or intends to discard, or is required to keep in order to discard, and includes such other thing, substance[57] or object as the Minister may prescribe.

14.13 Legal Notice 337 of 2001, *Waste Management (Permit and Control) Regulations,* provides the following explanation: 'waste' in addition to what is said in the principal Act means any thing, substance, product or object, whether in solid or liquid form, whether hazardous or otherwise, including those listed in Schedule 1 to these regulations, which the holder discards, or intends, or is required to discard, or any other which is deemed to be waste by the competent authority.

14.14 Legal Notice 337 of 2001 regulates all operations relating to the production and

oceans only "in emergencies posing unacceptable risk relating to human health and admitting no other feasible solution"); Annex II – the "grey list" (substances that can be dumped with special permits); and Annex III – materials that are allowed to be dumped under a general permit for all other wastes.

[56] Vide Expert Report, Conclusions and Recommendations prepared by *Axiak V*. in consultation with MEPA for National Workshop entitled Implementation of the 1998 Amended Protocol on Dumping at Sea, held on17th November 2005 on page 7.

[57] Under the EPA substances means any matter, chemical, mixture, compound or product and including fuels, combinations of elements, mixtures or compounds of a chemical reaction, as well as the mixture of substances of different molecular identities.

management of waste and promotes sound waste management practices so as to safeguard human health and the environment. It defines inert waste as *waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn, or otherwise react* [or] *affect other matter with which it comes into contact in any way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface and/or groundwater.*

14.15 This legislation is relevant as it defines inert waste. As discussed above the London Dumping Convention, the Protocol to it, and the Protocol on Dumping to the Barcelona Convention **exclude** from dumping at sea the placement of inert matter on the seabed for a purpose. This means that placing of inert material for land reclamation purposes is not termed as dumping at sea under these International Legal instruments. Maltese law does not make such a distinction. The obligation remains, however, upon the operators to ensure that the matter placed is inert and that marine pollution does not ensue, even if it is not "dumping of waste". Amendments to national legislation would also be necessary to ensure that the matter placed does not fall under the definition of "waste" under LN 337 of 2001.

14.16 If the "matter" for placement used in land reclamation operations is classified as waste by the competent authority, then it would be subject to the strict waste management regime under the LN 337 of 2001, even if it is not termed as dumping at sea. Consequently, although land reclamation has been identified as constituting placement of matter with a purpose, under international law and by the International Maritime Organization, if the matter used is classified as waste, these placement operations leading to land reclamation, would be regulated as a waste management operation under Maltese legislation.

14.17 Another relevant piece of national legislation is Legal Notice 128 of 1997, *Deposits of Wastes and Rubble Fees Regulations, 1997*. Even if the matter for land reclamation is not classified as waste under LN 337 of 2001, it would be made up mainly of rubble, the deposit of which is classified as a waste management operation under LN 128 of 1997. This Legal Notice, in fact, would hinder land reclamation operations in many ways because it:

- Contradicts the Dumping Protocols exemption, that placement of matter does not constitute dumping of waste at sea;
- Requires payment for the dumping of material according to its weight; and
- Only allows the deposit of dredging material at sea at, "a spoil ground for dredged material having a radius of about 350 meters and centred on Latitude 33°55.1'N and Longitude 14°34.0'E."[58].

14.18 The regulations would, therefore, need to be amended to permit the deposit of matter at sea in an area that is not the one described in the Legal Notice, otherwise it would be illegal to conduct any placement of rubble elsewhere[59]. If the London Dumping

[58] Vide LN 128/1997 Schedule B.
[59] Vide Ibid Regulation 3, which lays down, "No person may deposit any rubble, waste or hazardous waste in any site unless it is

Convention exempts the placement of matter for a purpose, then this legal notice should provide for this situation accordingly and exempt land reclamation operations from being equated to a waste management operation. In summary, unless LN 128 of 1997 is amended, land reclamation operations would be illegal and classified as deposit of waste at sea not placement of matter with a purpose.

14.19 The above discussion points to the fact that the following is required:

- Confirmation from the Competent Authority that the material to be used for land reclamation is not considered to be waste and therefore the provisions of Legal Notice 337 of 2001 do not apply; and
- Change to Legal Notice 128 of 1997 to allow for placement of matter on the seabed as in land reclamation operations.

National Planning Legislation

The Development Planning Act, 1992

14.20 This Act regulates and controls the use of land and the sea. The Act sets out the functions of the Authority as "*the promotion of proper planning and sustainable development of land and sea, …*"[60], and in particular requires that changes of use and development of land or sea be subject to permission granted by the Planning Authority[61]; such permissions may be subject to conditions.

14.21 Land reclamation projects would fall under the remit of the Development Planning Act as they constitute development at sea. A planning application would, therefore, need to be submitted to MEPA and approved before any project can be implemented.

14.22 In determining an application for development permission MEPA is required to apply:

- Development plans; and
- Planning policies.

14.23 MEPA is required to have regard to:

- Representations from the public; and
- Any other material consideration that the Authority may deem relevant.

14.24 The Structure Plan Policies relevant to land reclamation projects are identified in the Section on "Structure Plan for the Maltese Islands" below, and their implications on land reclamation operations are highlighted.

14.25 In defining "development", the Act specifically identifies "land reclamation from the sea" as

a waste deposit site".
[60] Article 5 (1) (a) of the Development Planning Act.
[61] Now the Malta Environment & Planning Authority (as of May 2002).

an activity that is considered to be "development in relation to the sea" (Art 30(4)).

14.26 The Act describes in detail the development control procedure, including informing the public of development applications, submitting to the Authority objections against the development proposed in the application, suspension of planning applications, granting / refusing development permissions, permit conditions and duration of permits, monitoring of major developments, compliance of permit conditions including the provision of one or more bonds by the developer to the Authority, the procedure for those decisions that need to be taken without delay, the Appeals procedure, and revocation of or modifications to development permits. The development control process would apply to any land reclamation project.

14.27 The regulations currently in force under the Development Planning Act that are relevant to reclamations in Area 1 or Area 3 include:

- Environmental Management Construction Site Regulations 2007, which set out requirements for all development sites; and
- Environmental Impact Assessment Regulations 2007, which establish the criteria for Environmental Impact Assessment and the procedures to be followed.

14.28 Neither of these instruments will inform the feasibility of reclamation in Areas 1 and / or 3. The Environmental Management Construction Site Regulations 2007 apply to construction and site management, and the Environmental Impact Assessment Regulations 2007 prescribe the conditions under which a project would qualify for an EIA.

Planning Policy

14.29 Planning policy relevant to land reclamation comprises policies embodied in the Structure Plan for the Maltese Islands, the Coastal Strategy Topic Paper, the Minerals Subject Plan, the "Space for Waste" Waste Management Subject Plan, the Position Paper on Disposal of Waste at Sea, the South Malta Local Plan, the Grand Harbour Malta Local Plan and the Central Malta Local Plan.

Structure Plan for the Maltese Islands

14.30 This section reviews the Structure Plan Policies relevant to the Scheme.

14.31 When the Structure Plan was being formulated, land reclamation in Malta had not been seriously contemplated. This is reflected in the Structure Plan's dearth of policies on land reclamation. Indeed, the Plan has no direct policies on land reclamation. The only policy that addresses reclamation, albeit to a limited extent, is policy RCO 23.

14.32 POLICY RCO 23: *Developments connected with the construction of coastal defences, the enlargement of existing beaches, and the creation of new ones will only be allowed following a scientific study by competent persons of their short term and long term environmental, social, and economic impact, and provided that it is clearly demonstrated*

that there is a real need for such development and that the benefits outweigh any negative impacts.

14.33 The Policy does not give guidance on land reclamation as such. However, projects that involve extension of beaches would require detailed studies. Given that MEPA requested a Feasibility Study that considers environmental as well as economic considerations of land reclamation in two areas, the spirit of the policy is being observed.

14.34 There are other sectoral policies within the Structure Plan that are applicable to Areas 1 and 3, although they do not concern land reclamation *per se*. These are policies regarding:

- Settlement Pattern (SET);
- Built Environment (BEN);
- Tourism & Recreation (TOU, REC);
- Transport (TRA);
- Conservation (RCO, MCO, CZM); and
- Public Utilities.

Settlement Policies

14.35 Policy SET 1 encourages development within existing built-up areas while Policy SET 8 states that development will be permitted in the areas designated for Temporary Provisions Schemes, in conformity with the requirements of policy SET 7 that give priority to community facilities, local employment, local shops, and finally housing.

14.36 Policy SET 8 has been revised as follows: *Development will be permitted in the areas designated in Temporary Provisions schemes, in conformity with Policy SET 7. The present layouts and other provisions of all such schemes will, however, be reviewed as part of the Local Plans to be prepared for areas in which these schemes are located. The change of the boundaries of Temporary Provisions Schemes, or the designation of new land outside these boundaries will only be made, if necessary, as the result of a comprehensive or partial Structure Plan review, which takes place after the preparation, and approval of a comprehensive topic study or following the approval of the related Local Plan. The Local Plan will, however, identify any matters, including boundary review matters, to be taken into account in the Structure Plan review*.

14.37 Paragraph 6.6 states that *in terms of effective land use distribution, Structure Plan analysis concluded that with one exception (para. 8.4 and Policy HOU 5), land for the development of new housing and ancillary facilities outside existing built-up areas should be dispersed in the locations given in the Temporary Provisions schemes rather than concentrated on one or more major sites. There may, on occasion, be the need, identified through a comprehensive topic study or through a Local Plan, to adjust the boundaries of the Temporary Provisions Schemes and to designate new land for a specific use outside the established development boundaries, to accommodate uses, which cannot be reasonably*

located on land already allocated for development. Such boundary changes and land designations should only take place within the context of a review of the Structure Plan, which may be comprehensive or partial (considering a single or a limited range of topics), since this enables regard to be had to the range of considerations which must be taken into account in such a change.

14.38 Although urban development is not allowed outside committed and built-up areas (Policy SET 11), policy SET 12 allows development that infringes the requirements of SET 11 if the applicant presents evidence that justifies infringement of the policy and submits an Environmental Impact Assessment. It is clear that the reclamation projects are outside the development zone and not in built up areas. It would appear that policy SET 12 would have to be applied should land reclamation projects involve development. Furthermore the Structure Plan amendment acknowledges that there may be the need, identified through a comprehensive topic study or through a Local Plan, to adjust the boundaries of the Temporary Provisions Schemes and to designate new land for a specific use outside the established development boundaries, to accommodate uses, which cannot be reasonably located on land already allocated for development. This Feasibility Study would be congruent with the requirements of Policy SET 8 as land reclamation is not contemplated in the Structure Plan. However, whether or not development located on the newly created land is justified as envisaged in these policies is debateable.

14.39 The Temporary Provisions Schemes boundaries and / or the relevant Local Plans would have to be extended (or specific ad hoc provisions included) so as to allow for land reclamation, if such projects are to go ahead.

Built Environment Policies

14.40 Any development proposed on the reclaimed areas would have to be assessed against policies BEN 1 to BEN 5.

Tourism & Recreation Policies

14.41 Both Areas have been identified by policies TOU 4 and TOU 6 as has their potential to be developed for tourism. A change in policy would be required to allow development on reclaimed areas if the latter are defined as part of the Maltese coastline.

14.42 This notion is further reinforced by the Coastal Zone Management Policies discussed below.

14.43 POLICY TOU 15: *The Planning Authority in co-operation with the Secretariat for the Environment and other relevant bodies will define a comprehensive policy for the coastal zone. This policy should aim at enabling Government to:*

- Assess the different components of the coastal zone considered as a unique ecosystem
- Identify permissible uses, development criteria, and standards
- Promote and enforce policies

- Include the coastal zone as an area requiring mandatory Environmental Impact Assessment procedures

14.44 See also Policies MCO and CZM.

14.45 Although this "comprehensive policy on the coastal zone" has yet to be formulated, the Coastal Strategy Topic Paper published by MEPA in 2002 gives good interim guidance on the issues outlined in this policy. Further details are given below.

Transport Policies

14.46 In accordance with the requirements of Policy TRA 2 the promoters of major developments will be required to prepare traffic impacts statements illustrating the likely impact of their proposals on the highway network. Parking provision will also have to be made in accordance with TRA 4. It is noted that the Structure Plan does not address maritime transport.

Rural Conservation Policies

14.47 POLICY RCO 1: Rural Conservation Areas are designated as illustrated in the Key Diagram. Within such areas the following sub areas will be designated, using World Conservation Union definitions and criteria where relevant:

- Areas of Agricultural Value: areas comprised of high-grade agricultural land including irrigated and partially irrigated land
- Areas of Ecological Importance: relatively large areas designated to protect typical and rare habitats
- Sites of Scientific Importance: sites containing individual species, groups of species, and geological features
- Areas of Archaeological Importance: concentrations of valuable archaeological sites
- Sites of Archaeological Importance: individual and/or isolated archaeological sites
- National Parks: relatively large areas of national significance not materially altered by human use, with managed visitor access and amenities
- Areas of High Landscape Value

14.48 The coastline in Area 1 is within the Central Malta Local Plan area. The entire coastline is designated for protection as a natural open coastal area with public access. Part of the coast, the wetland known as l-Ghadira s-Safra is a component of the Natura2000 network (INT 009) and is designated as a Candidate Special Area of Conservation of International Importance. It is also a Level 1 Area of Ecological Importance (protected by Government Notice 288 of 1995). Ghallis Rocks (Il-Gebla ta' L-Ghallis) is designated as a Level 2 Site of Scientific Importance under Government Notice 827 of 2002. Another scheduled area includes the Saline Marshland at Qalet Marku limits of Naxxar, protected as a Level 1 Area of Ecological Importance and a Level 2 Site of Scientific Importance (under Government

Notice 288 of 1995).

14.49 The coastline in Area 3 is within both the Grand Harbour and the South Malta local plans. Both plans propose that the general coastline be scheduled as a Site of Scientific Importance and as an Area of Ecological Importance. There is a presumption against development that would create negative impacts on these areas / sites.

14.50 Reclamation projects at both Areas are likely to negatively affect these designations, especially if the reclaimed area is urbanised. An Environmental Impact Assessment of the proposed project would be required to determine the extent of the impact on designated areas by any land reclamation.

14.51 POLICY RCO 2: Within Rural Conservation Areas and in accordance with Policy SET 11 no form of urban development will be allowed. However, in accordance with Policy BEN 5, applications for permission to develop structures or facilities essential to agricultural, ecological, or scenic interests will be favourably considered as long as the proposed development does not infringe the principles set out in Policy RCO 4 as subsequently detailed in the relevant Local Plan (Policy RCO 3). See also Policies RCO 7 and 8. With regard to existing buildings and other structures in Rural Conservation Areas, and other rural areas, the overall aim is to improve the rural environment. To this end the rehabilitation and suitable change of use of some buildings will be permitted, in conjunction with the removal of other buildings and structures which adversely affect the rural environment.

14.52 See comments in respect of SET 11 above.

14.53 POLICY RCO 4: The Planning Authority will not permit the development of any structure or activity which in the view of the Authority would adversely affect scenic value because it would:

- Break a presently undisturbed skyline
- Visually dominate or disrupt its surroundings because of its mass or location
- Obstruct a pleasant and particularly a panoramic view
- Adversely affect any element of the visual composition - for example, cause the destruction or deterioration of traditional random stone walls
- Adversely affect existing trees or shrubs
- Introduce alien forms, materials, textures, or colours

14.54 An environmental appraisal of the proposed reclamation projects is given in Chapter 15 of this Feasibility Study.

14.55 POLICY RCO 12: *In Local Plans, the Planning Authority will give protection ratings to Areas of Ecological Importance and Sites of Scientific Importance as follows*:

- LEVEL 1 zones will include important habitat types present only in small areas and/or sites with unique species or features

- LEVEL 2 zones will include important habitat types present in relatively large areas and/or sites with rare species or features
- LEVEL 3 zones will include areas where control is necessary to preserve habitats/species/features in adjacent sites
- LEVEL 4 zones will include habitats and/or features of general interest

14.56 Please refer to comments on Policy RCO 1.

14.57 POLICY RCO 15: *There is a general presumption against developments in urban and other built-up areas which are insensitive to the continued existence of identified features of scientific importance and significant elements of the country's natural heritage present within the area.*

14.58 The relevance of this policy varies according to the search area and, more particularly the extent and form of reclamation. An island connected by a causeway, for example, would not contravene this policy to the same extent as a reclamation that shifts the coast seawards.

Marine Conservation Policies

14.59 According to the 'Key Diagram' accompanying the *Structure Plan for the Maltese Islands*, neither Area 1 nor 3 lies within a candidate Marine Conservation Area (MCA). It is noted, however, that the Key Diagram is indicative only and that the extent of the MCA will be designated by MEPA, who can also propose other sites as MCAs.

14.60 POLICY MCO 2: focuses on marine archaeology and calls for both the inclusion of areas of marine archaeological importance within MCAs, and their strict regulation.

14.61 Details on the marine archaeology of Areas 1 and 3 are given in Chapter 7 of Technical Report 1 of this Feasibility Study.

Coastal Zone Management

14.62 The Structure Plan has only three policies in respect of coastal zone management. Policy CZM 2 calls for the preparation of a Subject Plan on coastal zone management "*to include both conservation of this important resource, and improved facilities for its enjoyment by the public*". In 2002, MEPA issued, for public consultation, a Coastal Strategy Topic Paper (*in lieu* of the Subject Plan mentioned in this Policy). Further details are in the relevant section below.

14.63 Policy CZM 3 is relevant to land reclamation projects that are adjacent to the existing coastline. It states that*: Public access around the coastline immediately adjacent to the sea or at the top of cliffs (including in bays, harbours, and creeks) will be secured. This will include taking shorelands into public ownership, Government acquisition of illegal developments and encroachments, and suitable construction works. In the few cases where this is not practical (for example where security consideration are paramount), nearby detours will be established. All the coastline will be brought into public ownership*

within a specified period.

14.64 Since the policy does not define the extent or location of the coastline (although this was later defined in the Coastal Strategy Topic Paper), it implies that the coastline (as redefined by reclamation projects) would have to be in public ownership and access for the general public assured. The application of this policy could be key to the future use of any reclamation and hence the feasibility of it.

Coastal Strategy Topic Paper

14.65 The Coastal Strategy Topic Paper was prepared by MEPA to identify issues that might affect the coastal zone and which would warrant consideration as part of the Structure Plan Review process. The Topic Paper provides a strategic direction towards sustainable development on the coast, within the broader concept of Coastal Zone Management[62].

14.66 The Topic Paper's strategy for the marine environment states: "*The primary objectives of the coastal strategy for the marine environment are to safeguard the natural and cultural heritage present; to safeguard legitimate marine uses, and to minimise existing and potential conflicts*". It advocates the designation of the MCAs identified in the Structure Plan, with the seaward boundary extending to the –50m depth contour, establishment of new aquaculture units beyond the -50m depth contour, and calls for a precautionary approach to development and for the application of Environmental Impact Assessment procedures.

14.67 The Paper reviews the status of the coastal environment, assesses the effectiveness of the current policy framework governing coastal resources and uses, and identifies the main issues that need to be addressed in the new Structure Plan. It identifies infrastructure as a major coastal use; reclamation is addressed in the section on infrastructure.

14.68 The Topic Paper also states that although land reclamation might be perceived as a form of inert waste management, it clearly states that it is not; the reclamation of land from the sea is considered to be marine-related development. The Topic Paper acknowledges that land reclamation projects are expensive to build and that structural stability is an essential consideration. It notes that shallow waters, required for land reclamation projects, are considered ecologically sensitive because of the likely presence of sensitive species such as *Posidonia oceanica*. In addition, on the shoreward side of the 50 m contour there are many other uses, including tourism and recreational uses that could be affected by land reclamation. Such impacts could include social and economic impacts. The Topic Paper concluded that "*the small size of the Maltese Islands and the intensity of existing coastal uses put an immediate limitation on the extent of development projects necessitating land reclamation from the marine environment*".

14.69 The coastal strategy directs development in accordance with the following set of objectives:

[62] Coastal Zone Management is the holistic process that aims to promote and maintain the sustainable development of a defined coastal area (MEPA, 2002).

- Protect coastal and marine habitats and biodiversity;
- Protect cultural heritage;
- Protect coastal uses that necessitate a coastal location;
- Promote and protect public access and use; and
- Minimise existing and potential user conflicts.

14.70 Since the coast in both Areas has little to no structural development, in accordance with the criteria laid down in the Topic Paper, the coastal areas in Areas 1 and 3 can be classified as predominantly rural. The strategy for these areas is *to safeguard the natural and cultural heritage, including landscape. The type and level of new development acceptable within these areas should be minimal. Only development that is directed towards improving degraded areas and enhancing informal recreation, in conformity with the objective of safeguarding the coastal characteristic and heritage of such areas, will be acceptable. Existing legally approved uses and development within protected areas should be allowed to continue, provided that the value of the protected coast is not affected negatively.*

14.71 In keeping with Structure Plan Policies CZM 2 and CZM 3, the Topic Paper seeks to assure public access for informal recreation.

14.72 The application of the policies of the Topic Paper is likely to detrimentally affect the feasibility of reclamation projects.

Space for Waste: the Waste Management Subject Plan

14.73 The *Waste Management Subject Plan, Space for Waste (2001)* [63] provides strategic long-term direction and context to guide both Government and the private sector in waste management issues. Its policies guide the strategic planning of waste management and the determination of development permit applications for developments and land use changes related to waste management facilities.

14.74 The Subject Plan is only relevant to the land reclamation insofar as the material that would be used for the reclamation, predominantly Globigerina Limestone, is currently generally considered to be inert waste and not a resource. The policies contained in the Subject Plan that are relevant are those concerned with the waste hierarchy (reduce, reuse, and recycle).

14.75 The Subject Plan reports that in 1997, some 750,000 tonnes of construction and development waste were disposed at Maghtab. It estimates that by 2000, construction and demolition waste arisings had increased to approximately 1.2 million tonnes. As also reported in the Minerals Subject Plan (2003), the Waste Management Subject Plan projects that by 2010, using a baseline total of 1 million tonnes and an assumed rate of economic growth of between 3 per cent and 4.25 per cent, 14 million tonnes of inert waste may be generated over the Plan period (2000 – 2010), an average of 1.4 million tonnes per

[63] MEPA October 2001.

annum.

14.76 MEPA has a number of policies on re-cycling. The Minerals Subject Plan indicates that MEPA would permit the location of recycling facilities and the storage of inert waste within operational quarries. The Waste Subject Plan indicates that MEPA would support initiatives and determine proposals for new waste management facilities in "accordance with the principles of sustainable development and the following waste management hierarchy: (i) Reduction, (ii) Re-use and recycling, (iii) Recovery, and (iv) Final disposal. The following policies are relevant:

- Policy SWM02: The Planning Authority will support public, private and voluntary sector initiatives to reuse, recover and recycle waste in accordance with the Policies in this Plan.
- Policy SWM03: The Planning Authority will support measures that encourage separation of waste at source for reuse or recycling.
- Policy SWM07: The Planning Authority will require Applicants of proposals that have the potential to generate large quantities of waste to provide specific information on measures to minimise waste generation and how waste will be managed in keeping with the principles of sustainable development. Proposals should also include provision for the separation and storage of different types of waste for recycling as appropriate.
- Policy SWM09: Applications for new waste management facilities should, where appropriate, include proposals for recycling of natural spoil and construction wastes for reuse as secondary aggregate or as material for landscaping or restoration.
- Policy SWM10: The Planning Authority will support proposals for temporary facilities on demolition and construction sites for the recovery, separation and where appropriate processing of waste materials generated by the on-site demolition or construction works provided that:
    - no waste materials are to be imported to the facilities at the site from elsewhere unless prior written authorisation is obtained from the Planning Authority and the Environment Protection Department;
    - the proposal will not give rise to unacceptable impact on local communities or the environment; and
    - the facilities are removed on completion of the demolition or construction project.

14.77 As noted in Chapter 4, it appears that although there is considerable Government support for the idea of implementing the waste hierarchy, in practice the construction industry's response is entirely market driven. The introduction of new technology by the private sector could reverse this trend, but as in the past, it would be in response to market forces, not Government policy. As things stand today, without Government's active push towards implementing the waste hierarchy, it is unlikely that there will be a reduction in the volume of waste generated.

14.78 The Waste Management Subject Plan, which was formulated in 2001, states that the introduction of a landfill charge for inert waste will act as an incentive for reuse and recycling of material. Inert waste arisings increased dramatically since the introduction of such fees, and there is little evidence of an increase in the recycling of Globigerina Limestone. Clearly the imposition of fees has had little effect on the volume of waste arisings.

14.79 The Subject Plan treats the issue of land reclamation very superficially. It states that *the use of inert waste materials for infill materials for land reclamation schemes and coastal defence works may be appropriate under certain circumstances. Careful controls over the import of such materials for these uses would be necessary to prevent any contamination to coastal waters*. MEPA's Position Paper on Dumping at Sea is discussed below.

14.80 In its discussion on disposal of inert waste the Subject Plan briefly addresses dumping at sea although it refers to the Position Paper. It states that although limited amounts of inert waste are currently disposed of at sea, this form of disposal is not considered to be a realistic or an appropriate long-term alternative to landfill. Disposal of such wastes at sea can give rise to significant environmental impacts. *Under certain special circumstances sea based disposal of inert waste may be considered where it can be demonstrated that it will not give rise to adverse impacts on the marine environment. Such proposals would be subject to environmental impact assessment requirements*.

14.81 The Subject Plan contains two policies on dumping at sea. It is MEPA's policy (not an international requirement) that dumping at sea should be avoided as much as practicably possible and should be considered as an option of last resort and should only be considered when all other land based disposal options have been discounted. The only wastes that could be considered for dumping-at-sea are inert wastes that originate from construction and demolition activities. Inert waste that has been contaminated with other types of waste cannot be considered suitable for dumping-at-sea, unless pre-treated and rendered completely inert.

- Policy SWM23: There is a presumption against the disposal of wastes at sea. Disposal of inert wastes would only be permitted at an official dumpsite if the proposal meets the following criteria:
    - The proposal needs to demonstrate that land-based disposal alternatives have been discounted and that disposal at sea is the Best Practicable Environmental Option (BPEO);
    - Only uncontaminated inert waste originating from construction and demolition activities shall be acceptable for dumping-at-sea;
    - Disposal of waste at sea will only be allowed in dumping sites, whether new or existing, that have an environmental monitoring programme in place and established control stations in the vicinity.

14.82 The Subject Plan states that under special circumstances disposal of certain controlled inert wastes may be appropriate for example as part of coastal reclamation or construction projects and where it can be demonstrated that adverse environmental impacts will not

occur. The identification of sites for such projects, including land reclamation schemes, should be guided by the provisions set out in policy SWM 24 and other appropriate policies of the Structure Plan and be subject to an Environmental Impact Assessment process.

- Policy SWM24: Proposals for new dumpsites will need to demonstrate (through an EIA process) that marine ecosystems and features of acknowledged importance would not be adversely affected.
- In particular disposal at sea will not be permitted in the following areas:
- Where disposal would have an adverse impact on existing legitimate uses and activities, such as fish farms, bunkering sites and other maritime activities;
- Fisheries grounds of economic significance;
- Breeding, nursery or feeding grounds for species of economic/ecological significance;
- Marine Conservation Areas;
- Bathing areas or upstream of bathing areas;
- Areas containing meadows of the sea-grass Posidonia oceanica;
- On or close to reefs;
- In large shallow inlets and bays;
- Important marine archaeological sites;
- Other areas that have habitats that require the designation of Special Areas of Conservation as listed in Annex 1 of the Habitats Directive 92/43/EEC;
- In areas where material is likely to be carried towards sensitive sites (as listed above) along the shore.

14.83 The only environmental impacts that will be acceptable are those caused by the physical effects of the dumped material. These physical effects include localised habitat change due to cover by dumped material. Assessment of any proposals for dumping waste at sea should include an extensive assessment of the land based impacts that would arise from vehicles transferring waste to the transportation vessels and also from the construction of transfer facilities on quays.

14.84 In the event that the use of inert waste in land reclamation is construed to be waste disposal / waste management, land reclamation must be guided by the requirements contained in policy SWM24. It is noted that the Coastal Strategy Topic Paper and the London and Barcelona Conventions (discussed above) indicate that such practices would not be regarded as waste management.

MEPA's Position Paper on Disposal of Waste at Sea

14.85 MEPA's Position Paper on Disposal of Waste at Sea envisages that certain construction projects involving development on the coast may require the dumping of waste at sea as an integral part of the project. Due to the diversity of such potential projects, it states that

the impacts of such projects must be considered according to their individual merits.

14.86 Currently, there is one approved official dumping site. The criteria for selecting this dumpsite have been influenced by maritime operations related to safety of navigation and possibly transportation costs.

14.87 Due to the number of uses carried out on the coast, including tourism, dumping should not be carried out close to shore.

14.88 MEPA's position on dumping at sea is summarised below:

- Dumping at sea will be avoided as much as is practicably possible. It will only be accepted if it can be demonstrated that alternatives have been considered and that dumping at the official despoliation grounds has been demonstrated to be the Best Practicable Environmental Option;
- Only inert waste from construction and demolition will be accepted for dumping at sea. Contaminated inert waste will only be considered if it is pre-treated (Legal Notice 337 of 2001);
- Municipal Solid Waste, industrial, and commercial waste will not be considered for dumping at sea;
- Only physical environmental impacts will be tolerated including localised habitat change due to cover by dumped material;
- Dumping at sea should only be carried out at official dumpsites, which require planning permission. The EIA regulations require an assessment of environmental impacts prior to the establishment of a new dumpsite;
- Dumping at sea should not be considered in areas that are:
    - Legitimate uses;
    - Fisheries grounds of economic significance;
    - Breeding, nursery or feeding grounds for species of economic/ecological significance;
    - Marine Conservation Areas;
    - Bathing areas or upstream of bathing areas;
    - Areas containing meadows of *Posidonia oceanica*;
    - On or close to reefs;
    - In large shallow inlets and bays;
    - Important marine archaeological sites;
    - Other areas that have habitats that require the designation of Special Areas of Conservation as listed in Annex 1 of the Habitats Directive 92/43/EEC;
    - Sensitive coastal areas; or
    - Areas where material is likely to be carried towards sensitive sites along

the shore;

- Dumping grounds require the preparation of an environmental monitoring programme, the designation of a buffer zone around the dumpsite, and the establishment of control sites in the vicinity;
- Dumping of inert waste at sea must be in accordance with all international, regional and national obligations after obtaining clearance from the bodies representing the respective instruments locally;
- Dumping at sea should be carried out in a way that re-uses the resource if possible, e.g. creation of artificial reefs; and
- Assessment of proposals for dumping waste at sea should include an assessment of the impacts that would arise from vehicles transferring waste to the transportation vessels and from the construction of transfer facilities on quays.

14.89 Although land reclamation operations are considered as placement of matter and not dumping at sea, MEPA's position on dumping of material at sea, especially the criteria for the areas that should / should not be considered for dumping are relevant. Of particular interest are the criteria relating to areas containing meadows of *Posidonia oceanica*, large shallow inlets and bays, and areas that have habitats that require the designation of Special Areas of Conservation as listed in Annex 1 of the Habitats Directive 92/43/EEC.

Central Malta Local Plan

14.90 The coast in Area 1 is within the Naxxar Local Council area, covered by the Central Malta Local Plan (CMLP), see Figure 14-1.

14.91 The Local Plan policies relevant to the coastal area address urban development, natural heritage, recreation, and rural rehabilitation.

14.92 Policy NA 04 deals with the protection of the Natural Coastal Area:

- MEPA will not permit urban development along the open coastal area of Naxxar, between Ghallis and Bahar ic-Caghaq, as designated in the Naxxar Coastal Policy Map. All efforts will be made in order to retain or reinstate these designated areas in their natural state.
- MEPA will however consider minor development including essential coastal pedestrian/cycle access improvements along a planned Coastal Walkway Route in line with Policy CG26 subject to and following the submission of a comprehensive Environmental Management Plan (EMP) for the area in accordance with Policy CG27. MEPA will also consider the feasibility of allocating a managed caravan site within Area 1 as indicatively shown on Map NAM 3.
- Developments allowed by this Policy will be subject to the following criteria that:
    - They will not cause a negative impact on any protected environmentally sensitive areas identified on the Naxxar Coastal and Rural Environmental Constraints Map and in accordance with the provisions of Policy CG22;

- Any developments, including any minor works, will be assessed against all environmental considerations identified in the relevant EMP for the area;
- They will not visually dominate or disrupt the natural coastal setting and landscape because of layout, design, style and materials used, and they will not introduce any extraneous forms, materials, textures or colours. In this respect, the introduction of cemented passages/areas on the natural rocky coast is not permitted;
- They will not adversely affect sites of coastal archaeological/historical importance;
- All parking areas will have suitable safe access/egress facilities so as to eliminate inappropriate parking and safety hazards on the arterial coast road; and,
- They are subject to the approval of other related agencies wherever necessary.

14.93 The Local Plan considers the coastal area of Naxxar to be of high ecological, scientific, and scenic importance. This stretch of coastline is considered to be of strategic importance because it is the only remaining open coastal gap between the heavily urbanised areas of Pembroke and Qawra. Depending on their extent, land reclamation projects on the coastline immediately adjacent to Ghallis / Bahar ic-Caghaq are highly likely to be incompatible with the requirements of Policy NA04.

14.94 Policy CG27 addresses Environment Management Plans. The formulation of Environmental Management Plans (EMPs) is required for the Coastal Walkway Route identified in Policy NA04 and Map NAM 03. The policy states that:

- MEPA will only consider proposals for recreation-related developments in the areas listed above following, and subject to, the recommendations of the relevant EMPs. MEPA reserves the right to require other EMPs, apart from those identified in the above mentioned priority list, if it deems the need for their preparation in respect of other proposals.
- In general the EMPs will be required to:
  - Resolve existing conflicts between land users in the rural areas through conflict resolution mechanisms and mediation processes;
  - Produce detailed management plans with site-specific proposals for the rehabilitation of abandoned and degraded agricultural areas, habitats and landscapes whilst defining allowable uses. These management plans are to include a detailed statement for any habitat engineering works;
  - Provide for the conservation of areas of environmental value, and to promote the educational use of important habitats where appropriate;
  - Introduce where appropriate public access and informal recreational activities in the countryside; and,

- Initiate the implementation of rural rehabilitation programmes through site specific agreements with involved key players.

- EMPs shall be implemented under the supervision of qualified persons to the satisfaction of MEPA and other relevant agencies.

14.95 Reclamation is not contemplated in the Local Plan.

Grand Harbour Local Plan

14.96 Area 3 falls partly within the Grand Harbour Local Plan (GHLP) area and partly within the South Malta Local Plan (SMLP) area as shown in Figure 14-2. The GHLP was approved in April 2002 and the SMLP was approved in August 2006. Draft amendments to the GHLP are currently available for public consultation[64].

14.97 Two policy areas are relevant to the feasibility of land reclamation in Area 3: the protection of natural heritage, and the designation of a site for public works. Additionally, according to the Local Plan, much of Area 3 should be subject to a coastal zone management programme.

14.98 Policy GE01 generally describes valleys, Areas of Ecological / Geological Importance and Sites of Scientific Importance and states that these areas are mainly located within the Ricasoli / Kalkara area. The policy notes that development that could prejudice the unique natural characteristics of these areas or adversely affect individual sites will not be permitted.

14.99 Policy GK15 identifies the coastal area along Ricasoli / Kalkara as a Site of Scientific Importance. In particular, the bay of il-Kalanka tal-Patrijiet is identified as an area of significant importance (Level 2) in terms of geomorphology, stratigraphy, palaeontology, and structural geology.

14.100 Policy GK24 refers to Structure Plan policy PUT 11, which identifies the Wied Ghammieq area as the site for a sewage treatment plant (see Kalkara Inset Map, GHLP). The explanatory text in the Local Plan states that the identification of the area was likely based solely on technical feasibility with little consideration given to other factors. It further identifies that the most suitable location in reality would likely be the site of the existing pumping station in terms of minimisation of environmental impacts.

Draft amendments to the Grand Harbour Local Plan

14.101 In 2006 MEPA proposed amendments to the Grand Harbour Local Plan; the amendments are currently under public consultation.

14.102 Policy GK20 earmarks an area that includes the Ricasoli Industrial Estate and an area to the south of the industrial estate, part of which has to date been considered as part of

[64] MEPA, 2006 Amendments to Grand Harbour Local Plan. MEPA website accessed on 19th December 2006: http://www.mepa.org.mt/Planning/local_plans/ghlp/amendments_public_consultation/Grand_Harbour_Local_Plan_amendments.pdf

Xghajra, for the development of an Information and Communication Technology (ICT) and Media Development City. In accordance with this policy, MEPA supports such a development because it will regenerate the area of the former Ricasoli Industrial Estate and its surroundings into an employment-led mixed-use development within a high quality working and living environment.

14.103 The extent of the coastal area that is protected has been reduced. The extent of area covered by amended policies GE01 and GK13 are illustrated in the Kalkara Inset Map (Figure 23 of the Amendments to the GHLP) (Figure 14-3).

South Malta Local Plan

14.104 The majority of the coastline in Area 3 is located in Xghajra and Marsaskala, both of which fall within the South Malta Local Plan Area, see Figure 14-4.

14.105 The coastal area that falls within the Xghajra Local Council area and part of the Marsaskala Local Council area is recommended for protection as an Area of Ecological Importance / Site of Scientific Importance. Policy SMCO 3 states that *in these areas/sites there will be a general presumption against development that would create negative impacts on these areas/sites and MEPA will endeavour to safeguard and protect AEIs and SSIs listed within this Local Plan.*

14.106 Part of the coast in the area of Il-Blata l-Bajda is designated in the Local Plan as a Valley Protection Zone. Policy SMCO 7 states that in these areas there will be a presumption against development that would negatively affect the functioning of the valley as a water catchment area.

Solid Waste Management Strategy

14.107 The Solid Waste Management Strategy for the Maltese Islands[65] (SWMS) provides a policy and decision-making framework for the future management of wastes, and for the preparation of detailed implementation plans. It is also the means by which the various requirements and targets contained in European Directives on waste will be implemented, in particular the Waste Framework Directive (75/442/EEC as amended by 91/156/EEC), and the Landfill Directive (99/31/EC) (see below).

14.108 The Strategy identifies the following key problems / deficiencies associated with the existing arrangements for wastes management:

- Policy and legislative framework;
- Institutional / organisational arrangements;
- Human resources / capacity;
- Financing / cost recovery;

[65] Ministry for the Environment, September 2001.

- Stakeholder awareness and communication;
- Data availability / reporting;
- Waste avoidance and reduction;
- Waste recovery and recycling;
- Waste segregation, storage, collection, and transport;
- Waste treatment / processing; and
- Final disposal.

14.109 The strategy proposes targets to achieve effective waste management: the targets for wastes from the construction industry are to reduce by 20% total arisings by 2005, recover 60% of rock / stone and recover 50% of mixed inert wastes. These targets have not yet been achieved; in fact waste arisings have increased substantially since the adoption of the Waste Management Strategy or the Waste Management Subject Plan. To date these two policy documents have been ineffective in realising the waste hierarchy.

National Environmental Legislation

Marine Pollution Prevention and Control Act

14.110 The Marine Pollution Prevention and Control Act[66] should be the main legal source under Maltese law to address marine pollution but despite being amended three times, it has never come into force. No regulations on marine pollution control from sea-based sources such as land reclamation have ever been issued under the Environment Protection Act.

14.111 Marine pollution may be regulated indirectly under the Water Framework Directive and the Habitats Regulations transposing the Habitats Directive, under conditions stipulated in an environmental impact assessment or the development permit for depositing/placing matter for a purpose. This round about way of regulating marine pollution exempts, however, a person responsible for polluting the marine environment from a criminal offence for such an action. If the appropriate legislation were in place, the person guilty of polluting the marine environment would still be liable for breaching the Habitats Regulations and the EIA Regulations. Without marine pollution legislation, the precautionary and preventive approach that would be necessary to permit placement of matter that would not go against the objective of the Dumping Protocols cannot be guaranteed. Before land reclamation operations can be put into effect, legislation that addresses marine pollution from sea-based sources must be in place and in force.

Environment Protection Act, 2001

14.112 The Environment Protection Act[67] requires everyone together with the government to protect the environment and to assist in the taking of preventative and remedial measures

[66] Chapter 227 of the Laws of Malta.
[67] Act XX of 2001.

to protect the environment and manage natural resources in a sustainable manner. Various duties that fall to the government are established:

- 4(a) to manage the environment in a sustainable manner by integrating and giving due consideration to environmental concerns in decisions on socioeconomic and other policies;
- 4(b) to take such preventive and remedial measures as may be necessary to address and abate the problem of pollution and any other form of environmental degradation in Malta and beyond, in accordance with the polluter pays principle and the precautionary principle;
- 4(c) to collaborate with other governments and entities in the protection of the global environment;
- 4(d) to disseminate information on the environment and to facilitate the participation of the public in decisions that affect the environment;
- 4(e) to apply scientific and technical knowledge and resources in determining matters that affect the environment;
- 4(f) to ensure the sustainable management of wastes and to promote its reduction and the proper use, reuse and recovery of matter and energy;
- 4(g) to safeguard biological diversity;
- 4(h) to combat all forms of pollution;
- 4(i) to consider the environment as the common heritage and common concern of humankind; and
- 4(j) to provide incentives leading to a higher level of environmental protection.

14.113 The Act also empowers the Minister responsible for the Environment to appoint an Authority[68] whose principal duties include:

- Advice to the Minister on environmental standards, guidelines, and the making of regulations;
- Issuing licences or permits;
- Establishing threshold discharges;
- Monitoring the quality of the environment; and
- Ensuring that Environmental Impact Assessments are properly carried out.

14.114 In addition, the Minister is empowered to make regulations *for the better carrying out of the provisions of the Act*, such regulations including prescription of fees and charges, establishment, co-ordination and enforcement of environmental quality control systems, making provision for carrying out environmental risk assessments, prescribe techniques for environmental monitoring, and set various objectives, issue directives and establish codes

[68] In March 2002, the Planning Authority (subsequently the Malta Environment & Planning Authority) was appointed the Competent Authority in terms of the Act (LN 57 of 2002 superseded by LN 107 of 2002).

of practice relating to waste management, integrated pollution prevention and control, and the protection of biodiversity.

14.115 The Act would apply to the implementation of the land reclamation schemes rather than to the actual permitting of the Scheme to be built.

14.116 The regulations currently in force under the Environment Protection Act that are relevant to land reclamation are discussed below. Of particular relevance to this Feasibility Study are the Flora, Fauna and Natural Habitats Protection Regulations that transpose the European Union's Habitat's Directive and Wild Bird's Directive– 92/43/EEC and 79/409/EEC respectively.

Nature Protection

14.117 **Legal Notice 311 of 2006:** *Flora, Fauna and Natural Habitats Protection Regulations* protects a number of flora and fauna species and provides for the establishment of a network of ecologically important areas (Special Areas of Conservation – SAC) on the basis of selected criteria with a view to protecting the habitats and species therein through the prohibition of activities that may threaten them and the formulation of management plans. Section 9(1) of LN 311 of 2006, in fact, provides for areas eligible for identification as SACs of national or of international importance, where on the basis of the criteria set out in Schedule IV (Stage 1) to these regulations and relevant scientific information, the Competent Authority," *shall, from time to time, propose a list of sites indicating with respect to each site which natural habitat types in Schedule I to these regulations and which species in Schedules II and III to these regulations that are native to Malta are hosted by the sites in question."* Although the Areas have not been designated as SACs, they may be so in the future and thus calls for stricter controls on the part of Competent Authority to grant development permits. It must be pointed out that a proviso to this regulation 9(1) provides for some leeway in this respect. It states: "*Provided also that for aquatic species, which range over wide areas, such sites will be proposed only where there is a clearly identifiable area representing the physical and biological factors essential to their life and reproduction".*

14.118 Neither Area is currently located within an SAC, SPA, or a marine protected area. However, Area 1 is close to the candidate MCA at Qawra Point, and includes a coastal terrestrial SAC (L-Ghadira s-Safra).

14.119 The Regulations also declare a number of natural habitats whose conservation requires the designation of special areas of conservation. Technical Report 1, Report on Benthic Surveys, shows that the extensive maerl beds and seagrass (*Posidonia oceanica* and *Cymodocea nodosa*) meadows off the northeastern coast of mainland Malta constitute a considerable proportion of the total area of seabed with these assemblage types in the Maltese Islands. In comparison, the seabed in the western half of Area 3 is already heavily modified by dumping of terrestrial material and discharge of sewage and does not support extensive areas with protected habitats such as maerl beds and seagrass meadows. Extensive maerl beds and seagrass (*Posidonia oceanica*) meadows are, however, present in the eastern half of Area 3.

14.120 The "*Posidonia* beds" are considered as 'priority habitats'. The two inlets present in Area 1, namely Qalet Marku and Bahar ic-Caghaq, may be both classified as a 'large shallow bay'[69] and consequently fall within the ambit of the *Flora, Fauna and Natural Habitats Protection Regulations, 2006.* Furthermore, the shallow rocky platform that comprises Ghallis Rocks may also fall within the ambit of these Regulations since it falls within the definition of a 'reef'[70]. All three habitat types are included in Annex I of the 'Habitats Directive' which lists natural habitats whose conservation requires the designation by Member States of Special Areas of Conservation. The local competent authority (MEPA) is required to set up a network of special areas of conservation (the National Ecological Network) for sites hosting the natural habitat types listed in Annex I of the 'Habitats Directive'.

14.121 Of relevance to the Feasibility Study is Article 19 that states:

- "19. (1) Where it appears to the Competent Authority that an application for consent under these regulations relates to an operation or activity which is or forms part of a plan or project which:–

[69] The *Interpretation manual of European Union habitats EUR27* (European Commission, 2007) defines 'Habitat 1160: Large shallow inlets and bays' as follows: "*Large indentations of the coast where, in contrast to estuaries, the influence of freshwater is generally limited. These shallow indentations are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well developed zonation of benthic communities*." Defined thus, large shallow inlets and bays are complex systems composed of an interdependent mosaic of sublittoral, littoral and adlittoral (terrestrial) biotopes, several of which are habitat types included in Annex I in their own right (e.g. sandbanks, seagrass meadows etc.). The term 'shallow' is defined in the 'Interpretation Manual' with reference to the phytosociological units *Zosteretea* and *Potametea*, which are not appropriate for the Mediterranean and are units which do not occur, or are very rare, the Maltese Islands. On the other hand, in a footnote, the 'Interpretation Manual' states that it is "*inappropriate to fix a maximum water depth, since the term 'shallow' may have different ecological interpretations according to the physiographic type considered and geographical location*." Given that the intention is to use the seagrass *Zostera* (as an indicator of lower limit) and that some EU member states include water down to 30m in their interpretation of this habitat type (e.g. the United Kingdom), Borg & Schembri (2003) proposed that the lower limit for 'shallow' in the case of Malta be taken as 40m, which is close to the maximum depth at which the seagrass *Posidonia oceanica* is normally found. Interpreted thus, 'large shallow inlets and bays' are large indentations of the coast, generally more sheltered from wave action than the open coast. They are relatively shallow, averaging less than 40m in depth. For the Maltese Islands, Borg & Schembri (2003) identified two main physiographic types that fall within the definition: (a) Embayments – bays in which the line of the coast follows a concave sweep between rocky headlands, with a wide or narrow mouth; and (b) Rias – a drowned river valley which in the local contexts translates to the mouth of a *wied* where it opens on the coast which has been inundated by the sea due to a post-Pleistocene rise in sea-level.

[70] The *Interpretation manual of European Union habitats EUR27* (European Commission, 2007) defines 'Habitat 1170: Reefs' as hard compact substrata on solid and soft bottoms, which arise from the sea floor in the sublittoral and littoral zone and which may be of either biogenic concretions or of geogenic origin, and which may support a zonation of benthic communities of algae and animal species as well as concretions and corallogenic concretions. The 'Interpretation Manual' interprets *"hard compact substrata"* as rocks boulders and cobbles; *"biogenic concretions"* as hard bottoms originating from dead or living organisms which supply habitats for epibiotic species; "g*eogenic origin"* as reefs formed by non-biogenic substrata; *"arise from the sea floor"* as the reef being topographically distinct from the surrounding seafloor; and *"sublittoral and littoral zone"* as that the reefs may extend from the sublittoral uninterrupted into the mediolittoral zone or may only occur in the sublittoral zone, including deep water. The 'Interpretation Manual' considers such infralittoral to circalittoral topographic features as vertical rock walls, horizontal ledges, overhangs, pinnacles, gullies, ridges, sloping or flat bed rock, broken rock and boulder and cobble fields to be included in this habitat complex if they fit the definition. In their discussion of Maltese reefs, Borg & Schembri (2003) consider that there is a far greater range and extent of rocky reefs than biogenic concretions in the Maltese Islands. Geogenic reefs range from vertical rock walls rising from the seabed to the surface and beyond (the underwater continuation of coastal cliffs), dropoffs (underwater cliffs) which may be sheer of stepped (Pirotta & Schembri, 1997a), rocky shoals (in Maltese: *sikka*) which are the equivalent of underwater hills rising from a more or less level bottom, and boulder fields. The common feature between these different forms is that a more or less vertical rock face arises from a level bottom that may be sedimentary or rocky, and that due to the steep gradient, the biotic assemblages present are characterised by attached algae and invertebrates, quite often showing a distinct zonation with photophilic species on the lighted upper reaches of the reef, and progressively sciaphilic ones in the darker lower regions.

- (a) is not directly connected with or necessary to the management of the protected site, and
- (b) is likely to have a significant effect thereon, either individually or in combination with other plans or projects, the Competent Authority shall make, or require the applicant to make, an appropriate assessment, of the implications of the operation or activity on the site in view of the site's conservation objectives.

- In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of sub-regulation (2) of this regulation, the Competent Authority may give consent to the operation or activity only after having ascertained that the plan or project will not adversely affect the integrity of the site concerned and if appropriate, after having obtained and taken into account the opinion of the general public and representations made within such reasonable time as the Competent Authority may specify.
- (2) If, in spite of a negative assessment of the implications for the site and the Competent Authority being satisfied that there being no alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, which subject to the subsequent sub-regulation, may be of a social or economic nature, the Competent Authority may give its consent for the operation or activity to be carried out.
- (3) Where the Competent Authority gives such consent under this regulation, shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.
- (4) Where the SAC concerned hosts a priority natural habitat type and, or a priority species, the reasons referred to in the previous sub-regulation must be either:-
  - (a) Reasons relating to human health, public safety or beneficial consequences of primary importance for the environment, or
  - (b) Other reasons which in the opinion of the Commission are imperative reasons of overriding public interest."

14.122 Although the Areas are not designated, impacts on priority habitats have to be considered. Development permission may be stalled if no measures can be taken to conserve the protected species from being damaged or destroyed if they occur in the areas where land reclamation would take place.[71]

14.123 Legal Notice 79 of 2006: *Conservation of Wild Birds Regulations* manages hunting and trapping and establishes Bird Sanctuaries. There are no bird sanctuaries within either Area. Part of the coastal area in Area 3 is intensively used for trapping and hunting. Details on the ornithology of the two sites are included in Chapter 8 of Technical Report 1

[71] Vide Regulation 24 (1) No person shall deliberately pick, collect, cut, uproot, destroy or damage in any way any specimen of species of flora listed in Schedules V (b) and VI (b) to these regulations." Similarly Regulation 25 (1) protects animal species occurring in Schedule V (a) and VI(a).

of this Feasibility Study.

Waste Management

14.124 Legal Notice 337 of 2001 has been discussed in paragraphs 14.3 to 14.19.

14.125 Legal Notice 168 of 2002: *Waste Management (Landfill) Regulations, 2002* provides measures, in addition to those described in Legal Notice 337 of 2001, to reduce the environmental impact from the landfilling of waste throughout the whole life-cycle of the landfill. The regulations describe three types (or classes) of landfill: landfills for inert waste, for hazardous waste, and for non-hazardous waste. Schedule 2 of the regulations set out the Waste Acceptance Criteria (WAC) for the three classes of landfill. WAC for disposal of waste in landfills are those listed in Council Decision 2003/33/EC.

14.126 This legislation is only relevant as it provides a framework for parameters to determine whether construction / demolition / excavation material is inert. There are no other national criteria for placing / dumping material in the sea.

Water

14.127 Legal Notice 194 of 2004*: Water Policy Framework Regulations, 2004* is issued under both the Environment Protection Act and the Malta Resources Authority Act. It establishes a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater. It states that there is one water catchment district for Malta and Gozo, and that catchment area management plans must be prepared. The framework is intended to prevent further deterioration of, and to protect, enhance, and restore the status of aquatic systems. It aims to promote sustainable water use based on a long-term protection of available water resources, and to enhance the protection and improvement of the aquatic environment through specific measures to combat polluting discharges. The regulations also deal with floods and the progressive reduction of pollution of groundwater.

14.128 This Legal Notice is applicable to the marine environment and, therefore, to any potential impacts that the reclamation may have on the quality of the marine environment, including any protected species.

Strategic Environmental Assessment & Environmental Impact Assessment

14.129 Legal Notice 418 of 2005, *Strategic Environmental Assessment Regulations*, transpose Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment. The SEA Regulations identify those plans and programmes that are liable to have significant effects on the environment and which, therefore, require a strategic environmental assessment. In order to be subject to an SEA, public plans/programmes must be:

- Prepared and/or adopted by a competent authority or prepared by a competent authority for adoption by means of a legislative procedure;

- Required by legislative, regulatory, or administrative provisions;
- Have significant effects on the environment;
- Propose future developments that may require an EIA in one or more of the following sectors: town and country planning or land use, transport, energy, waste management, water management, industry, telecommunications, agriculture, forestry, fisheries tourism or require an assessment under the Habitats Directive (transposed as Legal Notice 204/2001); and
- Have started after 21 July 2004.

14.130 For the land reclamation project to be subject to an SEA it must fulfill all of the above-mentioned conditions. A plan/programme will be exempt from an SEA if the sole purpose of the plan / programme is to serve national defence or civil emergency or refer to financial and budget plans such as the national budget estimates or the plan / programme has no significant environmental effect because only a small area is being affected or only a minor modification in the plan / programme is taking place.

14.131 It does not appear that land reclamation operations would fall under the exemption clause and, therefore, an SEA would likely be required for land reclamation plans or programmes. Notwithstanding, the SEA competent authority will be responsible for deciding whether an SEA is required.

14.132 Legal Notice 114 of 2007, Environment Impact Assessment Regulations, transposes Directive 85/337/EEC[72] (the Assessment of the Effects of Certain Public and Private Projects on the Environment (EIA)). The Regulations require that an Environmental Statement is prepared for projects that fall within Schedule I of the Regulations. Schedule I of the Regulations identify those projects that are required to undergo the EIA process. Land reclamation projects are listed in Section 4 of the Schedule. Land reclamation projects having an area of more than 1 hectare are required to prepare an Environmental Impact Statement; those having an area of more than1,000 m^2 would require an Environmental Planning Statement.

Access to Information

14.133 Legal Notice 116 of 2005: *The Freedom of Access to Information on the Environment Regulations, 2005* guarantee that anybody, without having to prove an interest, has the right of access to environmental information held by or for public authorities. They do not have an impact on the feasibility of land reclamation operations.

Other Legislation

Cultural Heritage Act, 2002

14.134 This Act provides overall protection to all movable or immovable objects of artistic,

[72] 85/337 EEC Official Journal L 175 of 5.7.1985.

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.

14.135 The Act also controls interventions that may be made on cultural property, all of which require a permit from the Superintendent of Cultural Heritage and are subject to tests, examinations or investigations. Furthermore, 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 [Section 43(1)]. Chance discoveries of archaeological remains are also regulated by the Act: "Any person who, even accidentally, discovers any object, site or building to which this Act applies in accordance with article 3, shall immediately inform the Superintendent, keep the object found in situ, and shall not for a period of six working days after informing the Superintendent proceed with any work on the site where the object of cultural property is discovered". The details about rights and obligations by all parties in the eventuality of an archaeological discovery are described in Sections 43(3), 43(4), 43(5), 43(6), and 43(7).

14.136 The marine archaeology features known from Areas 1 and 3 have been described in Chapter 7 of Technical Report 1.

14.137 If the reclamation projects are to go ahead a more detailed archaeological investigation of the specific reclamation areas must be undertaken in order to establish the exact nature of the objects identified and whether other archaeological features exist.

Council Decision 2003/33/EC

14.138 Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC requires that, in order to dispose of waste in landfills, certain criteria must be fulfilled. Table 14-1 lists the parameters that must be tested. It also contains the guideline values for acceptance at inert, non-hazardous, and hazardous landfills; these are referred to as Waste Acceptance Criteria (WAC).

Table 14-1: Waste Acceptance Criteria for Inert Stable non-reactive and Hazardous waste destined for Landfill

Eluates for compliance using BS EN 12457 - 3 at L/S 10/kg (2 batch)	**Inert Landfill (mg/kg)**	**Stable, non-reactive hazardous waste in non-hazardous landfill¶ (mg/kg)**	**Hazardous landfill (mg/kg)**
Arsenic (As)	0.5	2	25
Barium (Ba)	20	100	300
Cadmium (Cd)	0.04	1	5
Chromium (Cr)	0.5	10	70
Copper (Cu)	2	50	100
Mercury (Hg)	0.01	0.2	2
Molybdenum (Mo)	0.5	10	30
Nickel (Ni)	0.4	10	40
Lead (Pb)	0.5	10	50
Antimony (Sb)	0.06	0.7	5
Selenium (Se)	0.1	0.5	7
Zinc (Zn)	4	50	200
Chloride (Cl)	800	15,000	25,000
Fluoride (F)	10	150	500
Sulphate SO_4	1000	20,000	50,000
Total dissolved Solids (TDS)	4000	60,000	100,000
Phenol Index (PI)	1		
Dissolved organic Carbon at own pH or pH7.5-8.0	500	800	1,000
Total Organic Carbon (w/w%)	3%	5%	6%
Benzene, Toluene, Ethlybenzene, Xylene (BTEX) (mg/kg)	6		
PCBs (7 congeners) (mg/kg)	1		
Mineral Oil C_{10}-C_{40} (mg/kg)	500		
Polyaromatic Hydrocarbons (PAHs) - total 17 including coronene	100mg/kg		

14.139 No such values exist at a national level or at a European level for dumping of material in the sea. However, if the reclamation projects use only excavated material, it is unlikely that such values would be required. In other cases[73], for dumping at sea, MEPA has used the parameters contained in Council Decision 2003/33/EC to determine whether material was inert and therefore adequate for dumping at sea.

[73] For example the demolition of the former Ricasoli Industrial Estate.

Directive 2004/35/EC: The Environmental Liability Directive

14.140 Directive 2004/35/EC, better known as the Environmental Liability Directive, which came into force in all Member States on 30 April 2007, has various legal and administrative implications for the reclamation of land from the sea. At the time of writing (March 2008) it has not yet been transposed into Maltese national legislation. Environmental liability is a form of liability that is separate and is additional to civil and criminal liability. Its purpose is to award damages for harm caused to the environment *per se*, and the fines paid would be used to reinstate the environment that has suffered such damages. The term damage itself is defined as measurable adverse change in natural resources, measurable impairment of a natural resource service, which may occur directly or indirectly.

14.141 Land reclamation operations could, therefore, be subject to environmental damages on the basis of tort or negligence on behalf of the operators if environmental harm ensues. Such an action for environmental damages would be over and above any other action for civil and/or criminal liability. This legislation does not affect the Feasibility Study *per se*.

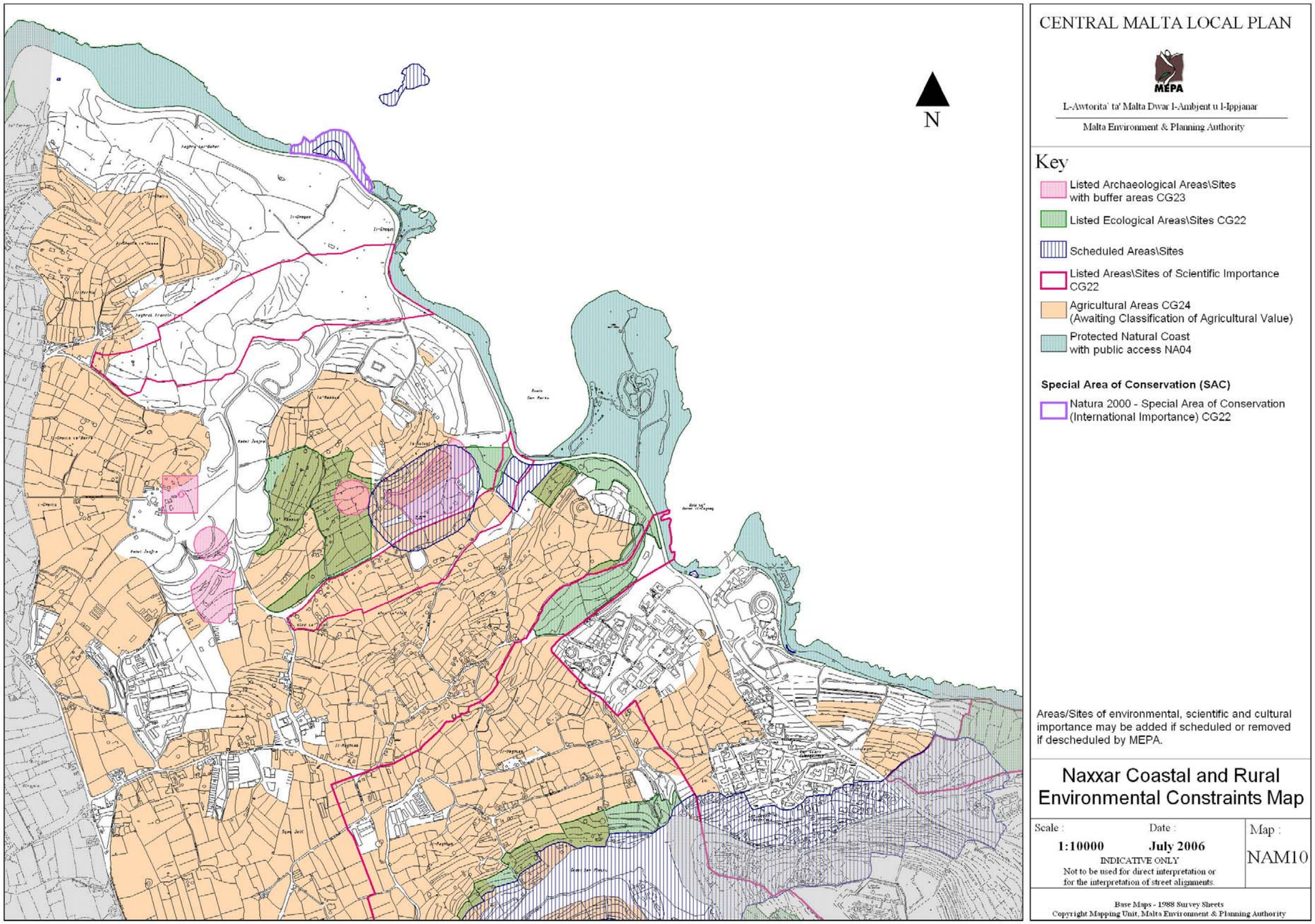
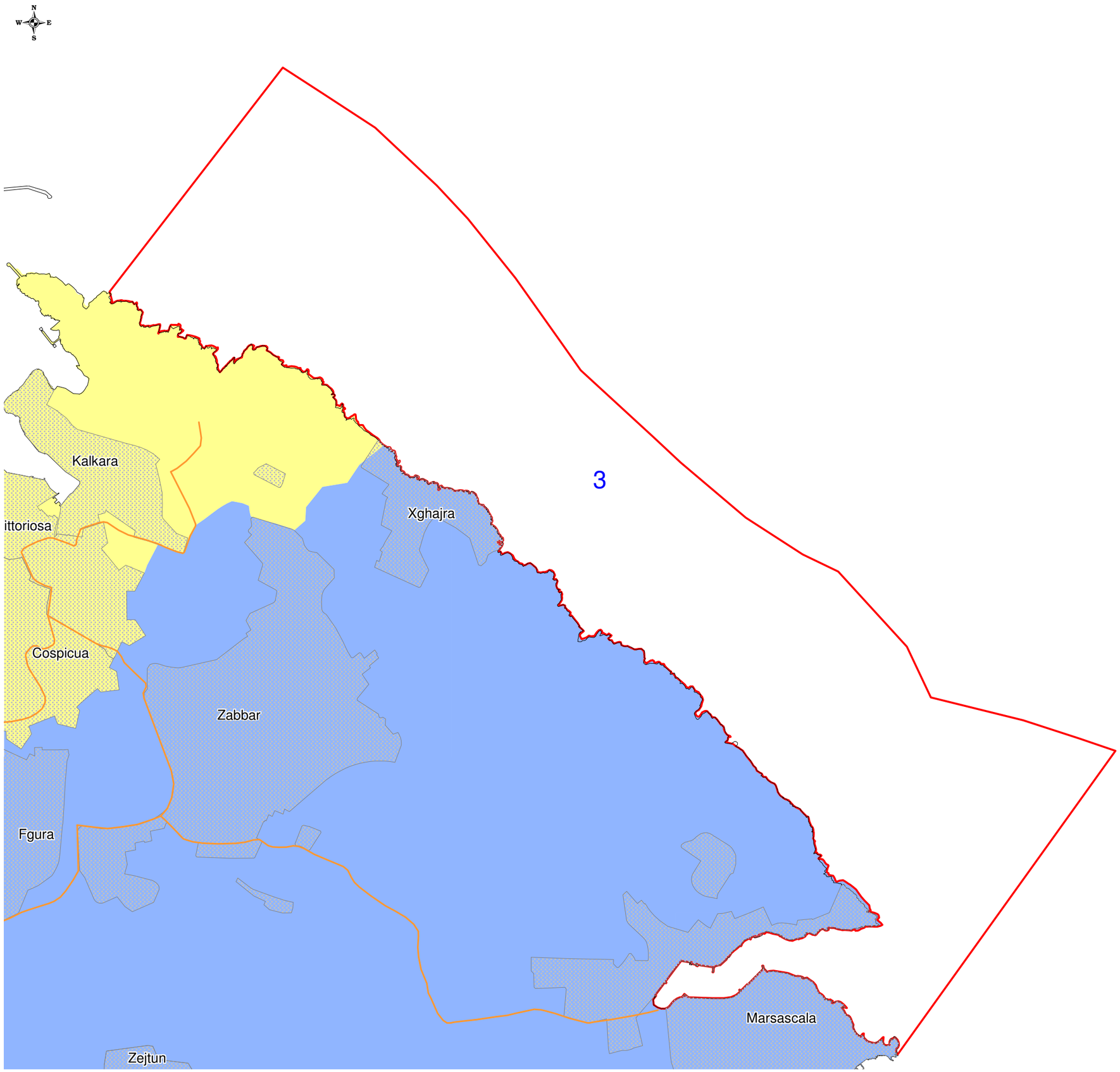


Figure 14-1: Naxxar Environmental Constraints Policy Map



Notes

- Search area boundary
- Grand Harbour local plan area
- South Malta local plan area

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

AREA 3: LOCAL PLAN AREAS

SCALE AT A3:

1: 21 000

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FIGURE NUMBER:

FIGURE 14-2

REVISION:

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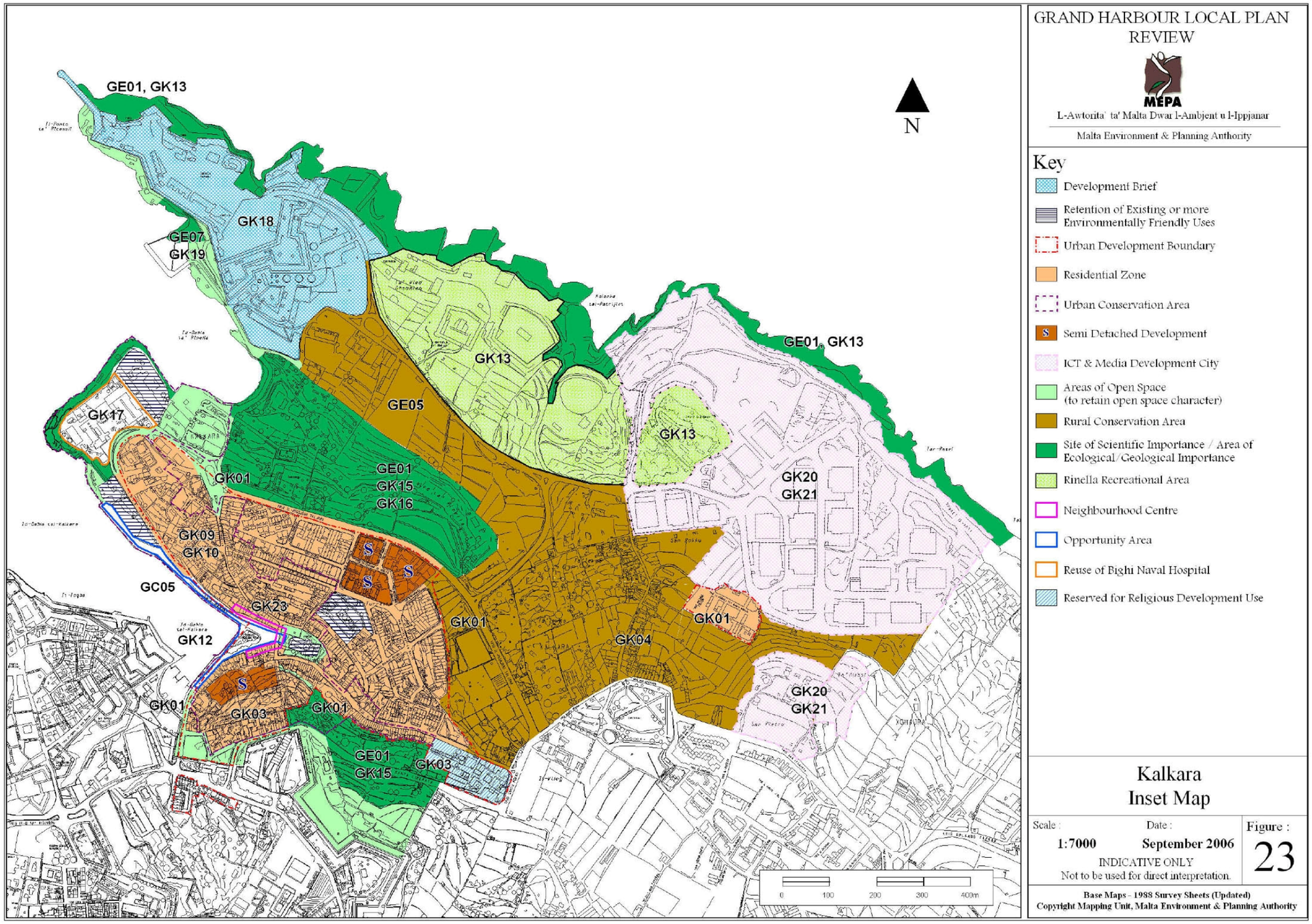


Figure 14-3: Kalkara inset map (revised GHLP)

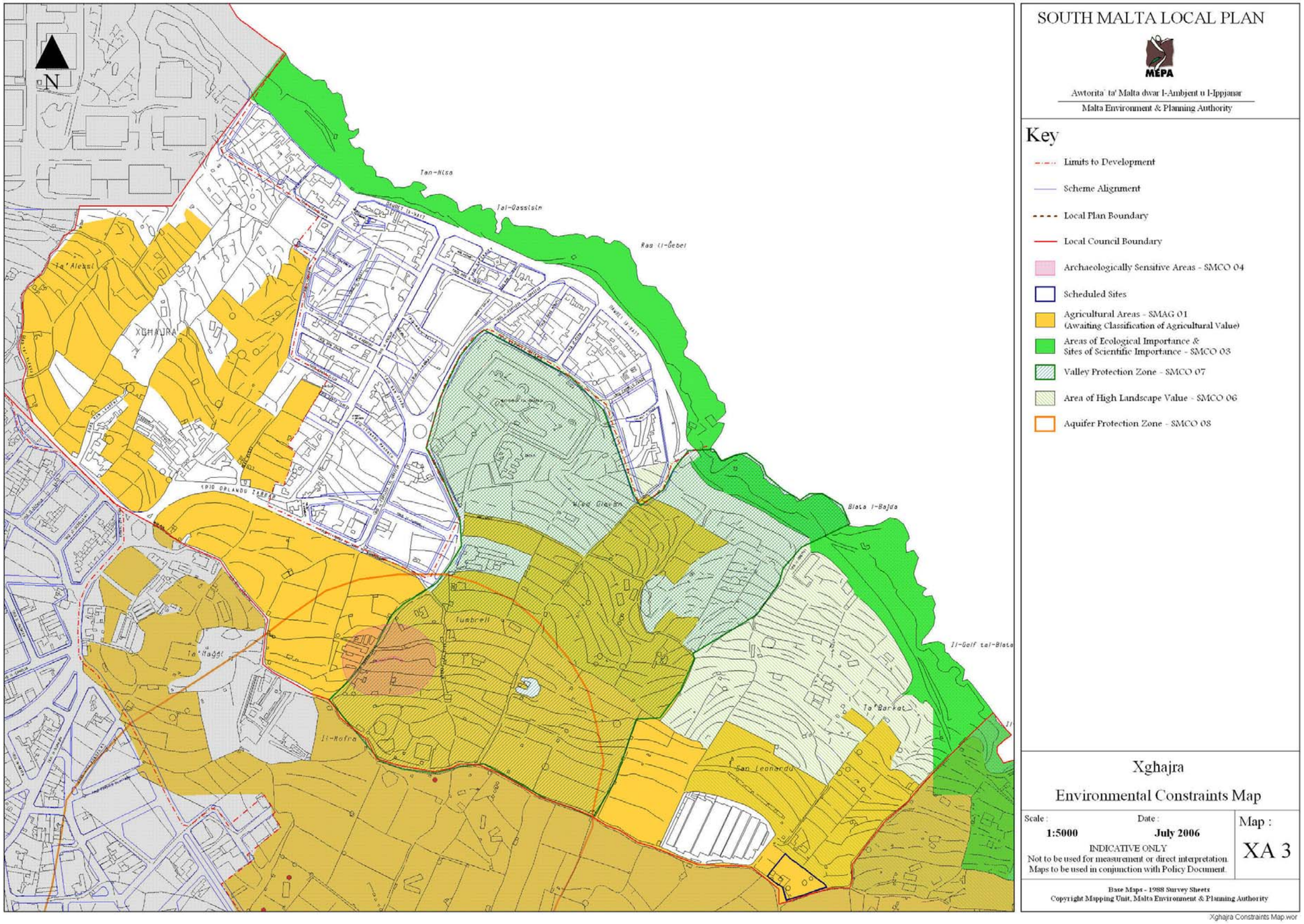


Figure 14-4a: South Local Plan - Xghajra Environmental Constraints Map

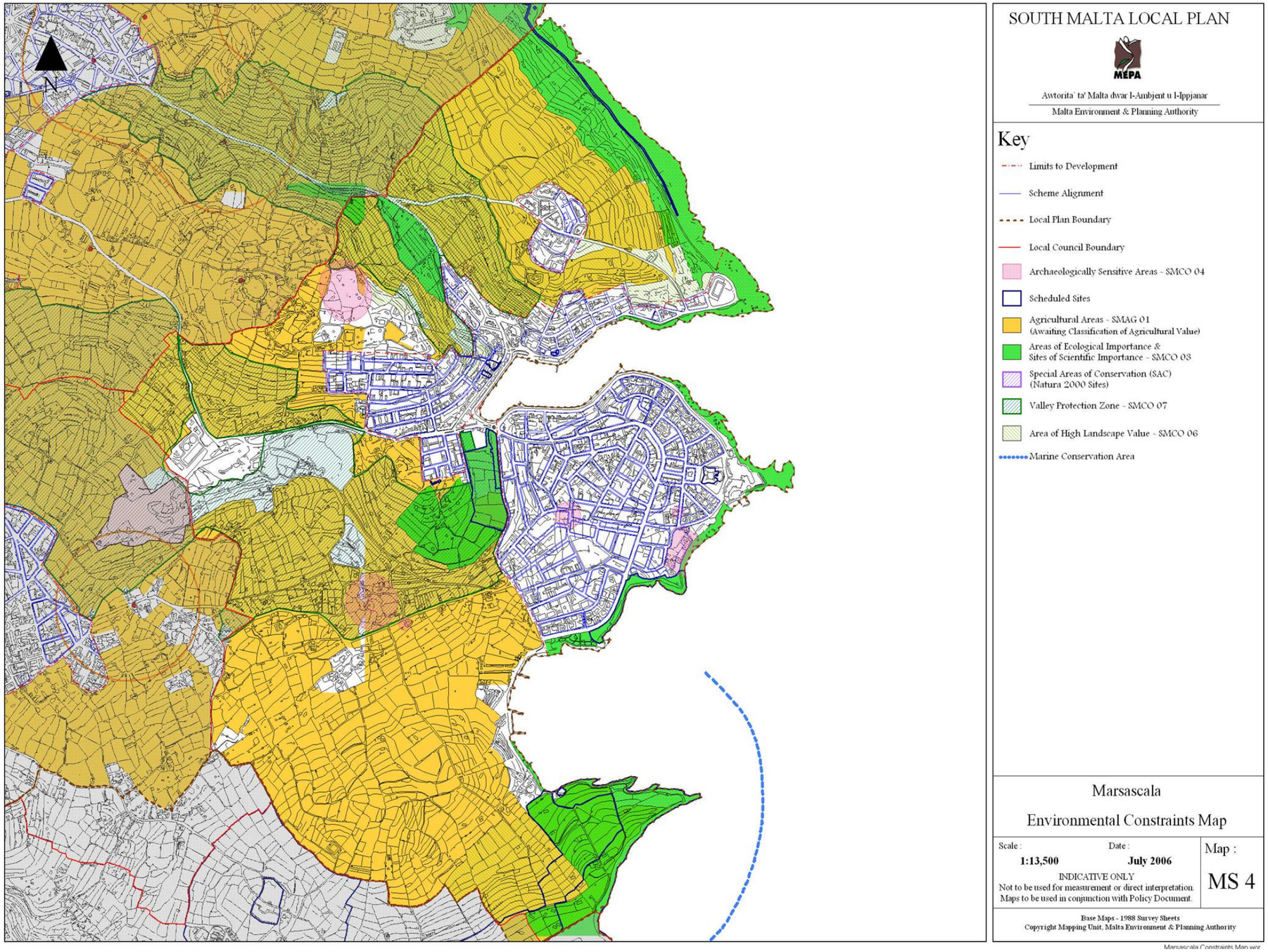


Figure 14-4b: South Local Plan - Marsascala Environmental Constraints Map

15 Environmental Appraisal

Introduction

15.1 This chapter presents the findings of the environmental appraisal of each reclamation shape and each after-use thereof.

15.2 The Environmental Appraisal involves a high level identification of the potential impacts that could result from the construction of each of the reclamation shapes[74] and operation of a range of potential after-uses as described in Chapters 6 and 9.

15.3 It must be emphasized that this Environmental Appraisal is only a high level assessment (akin to a Strategic Environmental Assessment) and should not replace the need for an Environmental Impact Assessment for any eventual reclamation project since the specific impacts of an actual project can only be identified once the details of the reclamation are defined.

Baseline Conditions & Constraints

15.4 The following is a review of the available baseline environmental information for the reclamation shapes in Areas 1 and 3 and the surrounding areas. A summary of this information is provided in Table 15-1. For more detailed information, the reader is referred to Detailed Investigations and Feasibility Studies on Land Reclamation at Two Indicated Search Areas, Malta, Technical Report 1, Volume 1.

Area 1

Marine Waters

15.5 Monitoring carried out by the Department of Public Health and the Environment Protection Department in 2005 indicates low levels of dissolved oxygen (average 52% saturation), low levels of nitrates (4.78 mg/l) and phosphates (0.02 mg/l). These values are applicable for Area 3 as well. Coastal water monitoring carried out by the Pollution Control Co-ordinating Unit of the Environment Protection Department and the Marine Ecotoxicology Laboratory of the University of Malta in June 2003 indicates a water temperature range between 25.3 and 26.5°C, a salinity range between 37.2 and 38.4 ppk, chlorophyll a measurements in the range of 0.185 to 0.518 µg/l, Beam Attenuation Coefficient (BAC) values ranging between 0.195 and 0.518, dissolved oxygen values ranging from 88.6% to 97.1%, and nitrate levels between 5.3 and 80.3 µg/l. No phosphate was detectable at the measuring stations. In March 2004, the water temperature was 15.1°C, salinity varied between 36.3 and 36.4 ppk, chlorophyll a measurements ranged from 0.377 to 0.764 µg/l, dissolved

[74] Note that the "reclamation shapes" included in this Report are only indicative of the size of reclamation required to accommodate a specific volume of material within the respective areas. The exact shape, footprint, and volume can, and will, change once a preferred location, if any, is chosen.

oxygen values ranged from 95.2% to 98.3% and nitrate levels were between 0.28 and 3.33 µg/l. Phosphate levels were at 0.22 µg/l.

15.6 In Area 1, both the tidal signature and the measured current are weak (maximum measured velocity of 0.37 m/s). Data collection and analysis carried out for Technical Report 2 indicate that there is strong evidence of response to wind forcing. Numerical modelling indicated that Ghallis rocks modify the circulation patterns depending on the direction from which the wind blows.

15.7 The wave climate is dominated by locally generated waves (of short period), rather than swells propagating into the area from a distance. Collection of wave data for Technical Report 1 indicated that waves arrive at Area 1 from two principal directions: 060° and 330°.

Marine Sediments

15.8 The seabed in Area 1 is gently sloping. Maerl beds interspersed with muddy heterogeneous sediments are found in the deeper parts (45 – 50m) of the seabed, whereas muddy heterogeneous sediments interspersed with maerl or rocky outcrops (probably Xlendi or Attard Member of the Lower Coralline Limestone Formation) characterise the intermediate depths (34 – 44m). The seabed in the shallower part of Area 1 (0 – 30m) consists of a heterogeneous mosaic of bedrock, soft sediments and accumulations of boulders, cobbles, pebbles and gravel. *Posidonia oceanica* meadows occupy an extensive area within this depth range. Ghallis Rocks and is-Sikka ta' Marku are two rocky shoals where water depth is less than 10m.

Marine Ecology

15.9 Six main benthic biocoenoses were recorded from the infralittoral zone in Area 1: (i) infralittoral algae, (ii) infralittoral stones and pebbles, (iii) *Posidonia oceanica* meadows, (iv) well-sorted fine sands, (v) coarse sands and fine gravels under the influence of bottom currents, and (vi) coarse sands and muddy heterogeneous sediment. Extensive beds of the other seagrass species recorded from the study area, *Cymodocea nodosa*, also occur. The biocoenosis of *Posidonia oceanica* meadows is the most extensive assemblage type. Many parts of the study area are characterised by a complex mosaic of two or more of the six main assemblage types identified.

15.10 *Posidonia oceanica* beds are listed as a 'priority habitat type' in Schedule I of the Flora, Fauna and Natural Habitats Protection Regulations, 2006[75]. *Cymodocea nodosa* beds are listed in Schedule III of the Flora, Fauna and Natural Habitats Protection Regulations, 2006. Large shallow inlets and bays, and reefs in Area 1 are also listed under these Regulations.

15.11 The pelagic and demersal fish encountered during the survey of Area 1 include Damselfish, Dolphinfish, Wrasses, Ornate Wrasse, Rainbow Wrasse, Painted Comber and Bream. Individuals of the jellyfish *Pelagia noctiluca*, Scorpion fish, Stingray *Dasyatis*

[75] LN 311 of 2006; this transposes the EU Habitats Directive into local legislation.

pastinaca, Moray Eel, Saupe, Red Mullet and Comber were also identified during such surveys.

15.12 Priority habitats (EU habitats directive), protected habitats by local or international legislation and protected species by local or international legislation are located on the seabed in reclamation shapes 1a, 1b, 1c, 1d, and 1e. All reclamation shapes, apart from reclamation shape 1b, are within 500m of an ecologically important designated site. Reclamation shape 1c also includes an ecologically important designated site within its footprint.

15.13 The majority of the proposed reclaimed areas in shapes 1b, 1d, and 1e, and about 50% of the proposed reclaimed areas in shapes 1a and 1c, coincide with *Posidonia oceanica* communities. All reclamation shapes in Area 1 also coincide with infralittoral algal communities and *Cymodocea nodosa* communities. .

Archaeology

15.14 Archaeological objects recovered from Area 1 include Roman shards, two Roman anchors, a Roman corn grinder, a ballast heap, and amphora necks from the late Roman or early Byzantine periods. The high archaeological potential of Area 1 stems from objects thrown or lost overboard while vessels approached Salina Bay, the possible presence of shipwrecks and the potential for preservation due to sediment deposition and the growth of *Posidonia oceanica* matte in the area.

15.15 There are no scheduled archaeological areas or sites present within the footprint of any of the proposed reclamation areas.

15.16 There are known archaeological deposits present within the footprint of reclamation shapes 1c, 1d and 1e.

15.17 Archaeological artefacts have been discovered within the footprint of reclamation shape 1a, 1c, 1d and 1e.

15.18 Based on published data and confirmed anecdotal evidence of past discoveries in the area, the seabed in reclamation shapes 1a, 1b, 1c, 1d and 1e has archaeological potential.

Ornithology

15.19 Breeding species of avifauna recorded in Area 1 include the Short-toed Lark, Zitting Cisticola, Sardinian Warbler and Spanish Sparrow. Quail and Short-eared Owls have also been recorded flying in the area. Spring and autumn produce the largest numbers and diversity of species. Wintering species recorded in Area 1 include the Black-headed Gull, the Mediterranean Gull, Black-necked Grebes and Great Crested Grebes. Movements of Cory's Shearwater, Yelkouan Shearwater, Great Cormorants and Gulls have been recorded within and offshore Area 1.

15.20 With the exception of reclamation shape 1b, there are known nesting sites for protected and other bird species present within 500m of the reclamation shapes.

15.21 A feeding area for protected bird species is only found in the footprint of reclamation shape 1c. Feeding areas for other bird species are found within the footprint of reclamation shape 1c.

15.22 There are known feeding areas for protected and other bird species within 500m of all reclamation shapes.

15.23 In strong winds, flyways within 1 km of all reclamation shapes are used by protected and other bird species.

Geo-environmental

15.24 The coastal area abutting Area 1 consists of karstland supporting marine garrigue and is thus of high ecological, scientific, and scenic importance. There are a number of Listed Ecological Areas / Sites and listed Sites of Scientific Importance. The coastline north of Pembroke is a Special Area of Conservation and candidate Natura 2000 site, as is the Ghadira s-Safra at Ghallis.

Area 3

Marine Waters

15.25 Coastal water monitoring in Area 3 between Il-Kalanka tal-Patrijiet and Zonqor Point, carried out by the Pollution Control Co-ordinating Unit of the Environment Protection Department and the Marine Ecotoxicology Laboratory of the University of Malta in June 2003, indicates a water temperature range between 25.3 and 25.8°C, a salinity range between 38.4 and 38.6 ppk, chlorophyll a measurements in the range of 0.389 to 1.442 µg/l and dissolved oxygen values ranging from 90.5% to 92.2%. No nitrate was detectable at the measuring stations. Phosphate levels were at 0.045 µg/l. In March 2004, the water temperature ranged between 14.8 and 15.1°C, salinity varied between 36.0 and 36.6 ppk, chlorophyll a measurements ranged from 1.22 to 5.69 µg/l, dissolved oxygen values ranged from 94.92% to 97.4% and nitrate levels were between 0.42 and 2.2 µg/l. Phosphate levels ranged from 0 to 7.35 µg/l.

15.26 Coastal water monitoring in Area 3 along the Xghajra coastline in June 2003 indicates a water temperature range between 25.3 to 25.8°C, a salinity range between 38.4 and 38.6 ppk, chlorophyll a measurements in the range of 0.389 to 1.442 µg/l, Beam Attenuation Coefficient values ranged between 0.415 and 0.559, and dissolved oxygen values ranging from 90.6% to 92.2%. No nitrate was detectable at the measuring stations. Phosphate levels were at 0.045 µg/l. In March 2004, the water temperature ranged between 14.8 and 15.1°C, salinity varied between 36.0 and 36.6 ppk, chlorophyll a measurements ranged from 0.835 to 5.68 µg/l, Beam Attenuation Coefficient values ranged between 0.199 and 3.589, dissolved oxygen values ranged from 94.9% to 97.4% and nitrate levels were between 0.42 and 2.2 µg/l. Phosphate levels ranged from 0 to 7.35 µg/l.

15.27 Coastal water monitoring in Area 3 at Marsaskala in June 2003 indicates a water temperature range between 25.6 and 26.1°C, a salinity range between 38.4 and 38.8 ppk,

chlorophyll a measurements in the range of 1.469 to 6.738 µg/l, Beam Attenuation Coefficient values ranged between 0.451 and 1.226, dissolved oxygen values ranging from 78.9% to 86.5% and nitrate levels between 2.56 and 5.07 µg/l. Phosphate levels were at 0.045 µg/l. In March 2004, the water temperature ranged between 14.8 and 15.4°C, salinity varied between 36.7 and 36.9 ppk, chlorophyll a measurements ranged from 1.136 to 4.975 µg/l, Beam Attenuation Coefficient (BAC) values ranged between 0.209 and 0.511, dissolved oxygen values ranged from 95.6% to 100% and nitrate levels were between 3.47 and 8.30 µg/l. Phosphate levels ranged from 0 to 0.131 µg/l.

15.28 In Area 3, both the tidal signature and the measured current are weak (maximum velocity of 0.35 m/s). Much of the wave climate is locally generated and the two principal wave directions are 070° and 300 - 340°. Waves that could directly attack Area 3 are from a directional sector from 330° to 120°.

Marine Sediments

15.29 The seabed in Area 3 slopes steeply to a maximum depth of 53m; it is considerably disturbed by large-scale dumping of construction / demolition waste, and the presence of a major sewage outfall in the Western sector, and harbour activities at Marsaskala Bay in the East. The seabed between 20 and 50m in the northwest corner of Area 3 consists of dumped material. At depths of 46 – 50m, the seabed mainly consists of maerl beds interspersed with coarse sands and muddy heterogeneous sediments. Between 25 and 45m, the seabed is characterised by soft sediments interspersed with maerl and / or rocky outcrops. At depths of around 19m to 24m, the seabed consists of bedrock interspersed with soft sediment that, in places, was covered with accumulations of detached algae and seagrass leaf litter. Bedrock (probably il-Mara and Xlendi Member of the Lower Coralline Limestone Formation) characterises the seabed in depth between 7 and 18m.

Marine Ecology

15.30 Eight main benthic biocoenoses were recorded from the infralittoral zone in Area 3: (i) infralittoral algae, (ii) infralittoral stones and pebbles in shallow water, (iii) infralittoral stones and pebbles in deep waters, (iv) infralittoral gravels, (v) *Posidonia oceanica* meadows, (vi) coarse sands and muddy heterogeneous sediment, (vii) coarse sands and fine gravels under the influence of bottom currents, and (viii) polluted harbour mud and sandy mud. The biocoenosis of coarse sands and muddy heterogeneous sediment is the most extensive assemblage type. Beds of the other seagrass species recorded from the study area, *Cymodocea nodosa*, also occur in Marsaskala Bay.

15.31 *Posidonia oceanica* beds are listed as a ‘priority habitat type’ in Schedule I of the Flora, Fauna and Natural Habitats Protection Regulations, 2006. *Cymodocea nodosa* beds are listed in Schedule III of the same regulations.

15.32 The pelagic and demersal fish encountered during the survey of Area 3 include Damselfish, Wrasses, Ornate Wrasse, Rainbow Wrasse, Painted Comber, Bream and Little Tunny. Individuals of the jellyfish *Pelagia noctiluca*, Grey Mullet, Saddled Bream,

Scorpionfish, Moray Eel, Saupe, Red Mullet and Comber were also identified during a survey of the area.

15.33 Priority habitats (EU habitats directive), protected habitats by local or international legislation and protected species by local or international legislation are located on the seabed in reclamation shapes 3a, 3b, 3c, 3f, and 3g.

15.34 All reclamation shapes are within 500m of an ecologically important designated site.

15.35 The majority of the proposed reclamation areas in shapes 3a, 3b, 3c, 3d, 3e, and 3f coincide with infralittoral algal communities. Reclamation shapes 3a, 3b, 3c, and 3f also coincide with *Posidonia oceanica* communities. Reclamation area 3g overlaps for most of its area with *Posidonia oceanica* communities.

Ornithology

15.36 Breeding species of avifauna recorded in Area 3 include the Short-toed Lark, Zitting Cisticola, Sardinian Warbler, Spanish Sparrow, Common Swift and Tree Sparrow. Quail and Short-eared Owls have also been recorded flying in the area. Spring and autumn produce the largest numbers and diversity of species. Wintering species recorded in Area 3 include the Black-headed Gull, the Mediterranean Gull and single Cormorants. Movements of Cory's Shearwater, Yelkouan Shearwater, Storm Petrels, Single Gannets, Great Cormorants and Gulls have been recorded within and offshore Area 3.

15.37 There are known nesting sites for protected and other bird species present within 500m of all reclamation shapes.

15.38 No known feeding areas for protected bird species are present within the footprint of any of the reclamation shapes. Other bird species congregate to feed over the sewage outfall in Area 3 (reclamation shapes 3d and 3e).

15.39 There are known feeding areas for protected and other bird species within 500m of all reclamation shapes.

15.40 In strong winds there are flyways used by protected and other bird species within 1 km of all reclamation shapes.

Archaeology

15.41 The main archaeological 'objects' discovered on the seabed of Area 3 or within its vicinity consists of a series of modern wrecks datable to the Second World War: Schnellboot S-31, HMS St Angelo, HMS Eddy, The Hellespont and HMS Southwold. There are also a number of aircraft from the same period. The archaeological potential of Area 3 is high because the area has witnessed human maritime activity for at least 4,000 years[76], the presence of sediment deposits would ensure the preservation of any ancient wrecks, and the concentration of Second World War artefacts could point to further unrecorded objects.

[76] The Search Area is located between two important harbours: Grand Harbour in the West and Marsaskala Bay in the East.

15.42 There are no scheduled archaeological areas or sites present within the footprint of any of the proposed reclamation areas.

15.43 Archaeological artefacts have been discovered within the footprint of reclamation shape 3d.

Geo-environmental

15.44 The coastal area and valleys within the Ricasoli / Kalkara area are scheduled or listed as Areas of Ecological / Geological Importance and Sites of Scientific Importance in the respective Local Plans. Part of the Ricasoli peninsula coincides with a scheduled Area of High Landscape Value.

Potential Impacts

15.45 The potential impacts of reclamation and the afteruse of each of the reclamation shapes is described in Table 15-1 and Table 15-2. The impact criteria reflect a range of considerations related to the protection status of the reclamation site and its environs, the importance of the site and its environs to functioning of environmental systems, water quality,, compatibility with man's current uses of the reclamation site and its environs, the effects on landscape and visual amenity of the area, and the effects on communities lying close to the reclamation site

Impacts arising from reclamation construction

15.46 Table 15-1 shows that there are a number of potential impacts that could potentially be associated with the reclamations as described elsewhere in this Report.

15.47 The principal impacts are:

- Increased turbidity of the water column: This is caused by particles in suspension. The smaller the particles, the longer the suspension period[77]. Increased turbidity of the water column reduces the penetration of light, negatively affecting both benthic habitats and plankton. Pelagic species may also be affected, especially through clogging of fish gills that can lead to increased mortality. The extent of the impact will depend on the release of fines during deposition and the water circulation pattern in the area;
- Obliteration of benthic environments immediately beneath the reclamation[78];
- Smothering of benthic habitats from the settlement of suspended particles: material released during deposition will eventually settle on the seabed. Where this occurs, the area could be severely impacted and the local benthic environment smothered.

[77] As witnessed in local coastal projects in the past (e.g. development of Portomaso and the Cirkewwa Ferry Terminal), the release of fine Globigerina Limestone dust into the marine environment results in extensive surface plumes of turbid waters, which do not settle but are instead dispersed by currents and waves over a large area of sea.

[78] Since coastal areas are among the most productive marine locations, impacts in this area will invariably be highly significant, affecting ecology, fisheries, water quality, recreation, etc.

The longer the duration of the fines settlement process, the wider the affected area.

- When material is deposited in shallow coastal areas, the impacts will also include change in currents and hydrodynamic regime of the area, and the promotion of associated impacts related to water transport processes (such as changes in water mixing rates and patterns, rate of nutrients and oxygen replacement, and rates and patterns of dispersal of pollutants from terrestrial runoff) sediment transport processes (such as coastal erosion and sediment accumulation).
- Noise, vibration and emissions to air; and
- Discharge of silt-laden (and possibly hydrocarbons) stormwater.

15.48 The construction process of reclamation areas contiguous to the coastline also entails the obliteration of the surface terrestrial geology and habitats up to a certain distance from the coastline. This impact is not associated with the construction of island reclamation areas.

15.49 As shown in Table 15-1, all reclamation shapes in Area 1 are within areas identified as priority and protected habitats, and in particular the *Posidonia oceanica* meadows. The footprint of each reclamation shape is also likely to impact protected species. Shape 1c is likely to impact ecologically important designated sites, and all except shape 1b are also within 500 metres of ecologically important designated sites.

15.50 All of the reclamation shapes in Area 1 have archaeological potential and artefacts have been discovered and documented for most of the reclamation footprints. For reclamation to proceed, it would be incumbent on the proponent to undertake extensive archaeological reconnaissance.

15.51 All of the reclamation areas in Area 1 are recognised feeding areas for protected birds and they are used as flyways, particularly in periods of strong winds. With the exception of shape 1b, the footprint of all reclamation shapes are known to be nesting sites for protected avifauna.

15.52 Although only shape 1c covers a designated geological site, the remainder are within 500 metres of such a designated area (most much less). Such area would be threatened by reclamation works.

15.53 Water quality is likely to be impacted by all reclamation works, and all but shape 1b are likely to affect recognised recreation areas. None of the shapes will conflict with shipping or commercial fishing, and three shapes will not affect salt harvesting.

15.54 Although the visual amenity and landscape of the coast in Area 1 will be detrimentally affected by all reclamation shapes, none will affect communities though dust nuisance, noise and traffic.

15.55 In Area 3, all but shapes 3d and 3e are within areas identified as priority and protected habitats, and the footprint of each of these reclamation shape is also likely to impact protected species. However, none covers an ecologically important designated site.

15.56 Although all reclamation shapes in Area 3 except shapes 3a and 3g are within 500 metres

of a designated or known archaeological site, none of the shapes covers an area that is specifically protected, and only shape 3d is known to have yielded cultural heritage artefacts.

15.57 The ornithological and geo-environmental aspects of Area 3 are similar to those pertaining to Area 1. Reclamation in Area 3 is not likely to affect water quality designations. With the exception of 3g, however, all Area 3 reclamation shapes will affect recognised recreation areas. Shapes 3d and 3e lie on the shipping approaches to Grand Harbour, but none will affect commercial fishing.

15.58 All shapes in Area 3, excepting shapes 3d and 3g, have the potential to affect salt harvesting. The visual amenity and landscape of the coast in Area 3 will be detrimentally affected by all reclamation shapes, and with the exception of shape 3g, all will detrimentally affect adjacent communities as a result of dust nuisance, noise and traffic.

Impacts arising from afteruse

15.59 While recognising that the majority of the significant impacts will arise during the reclamation process, it is important to appreciate that the effects of the afteruse are also important because they will be perpetual or on-going.

15.60 Table 15-2 describes the effects of the afteruses described in Chapter 9 on the same criteria that were applied in respect of construction.

15.61 The principal impacts of the afteruses considered are:

- Passive development in the form of a nature sanctuary or parkland for informal recreation will not result in any major negative impacts on the surrounding marine and terrestrial habitats and species[79]. The concentrated discharge of freshwater and sediment following rainfall events will negatively affect benthic habitats in the region; the extent of the impact depending on the extent of turbidity in the surface flow and the type of habitats present in the surrounding areas. Overland flow pollution during the construction phase may affect the marine protected habitats and species surrounding all reclamation shapes. Noise and air pollution during the construction phase may affect the terrestrial ecologically important areas in the vicinity of all reclamation shapes apart from 1b. Passive development may result in the expansion of existing terrestrial protected habitats and species and an increase in their appreciation by the public.
- Stormwater discharge from all afteruses will be concentrated to specific area, affecting water salinity and temperature;
- Marinas and beach development are likely to locally reduce water currents thus affecting siltation and flushing of pollutants;
- Noise, emissions and traffic arising from all afteruses, but more particularly the

[79] It must, however, be emphasized that the creation of such an artificial nature sanctuary / parkland would in itself have obliterated natural protected habitats within its footprint; hence, the substitution of a natural area with an artificial one would essentially constitute a reduction in biodiversity value.

urban and port / industrial uses are likely to affect nearby communities, particularly in the vicinity of Area 3 where settlements lie close to the coast;

- Increased recreational use of the sea in the vicinity of each of the reclamation shapes, and particularly scuba diving (if unregulated) could result in the loss of cultural artefacts from the seabed;
- Nesting areas, feeding areas and flyways could be detrimentally affected by the development of urban afteruses, but positively impacted by the development of the passive afteruses and golf courses;
- Water quality could be affected to a minor extent by urban discharges (e.g. from roads and other hard surfaces), and from discharges / antifouling associated with shipping and industrial uses. Discharges to air and sea from facilities such as desalination plants, and waste processing plants (either STP or biowaste facilities) are likely to affect both air and water quality;
- Afteruses that involve shipping and port-related activities could prevent the recreational use of the coast in the vicinity of the reclamation;
- All urban afteruses are likely to affect the visual amenity and landscape value of the area.

Table 15-1: Impacts of Reclamations

		Area 1					**Area 3**						
		Reclamation Shapes					**Reclamation Shapes**						
Topic	**Criterion**	**1a**	**1b**	**1c**	**1d**	**1e**	**3a**	**3b**	**3c**	**3d**	**3e**	**3f**	**3g**
Ecology (marine & terrestrial)	Are Priority Habitats (EU Habitats Directive) present within the footprint of the proposed reclamation shape?	Y	Y	Y	Y	Y	Y (part)	Y (part)	Y (part)	N	N	Y (part)	Y
	Are Protected Habitats (local or international legislation) present within the footprint of the proposed reclamation shape?	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y
	Are Protected Species (local or international legislation) present within the footprint of the proposed reclamation shape?	Y	Y	Y	Y	Y	Y	Y	Y	N?	N?	Y	Y
	Are ecologically important designated sites (including Local Plan provisions) present within the footprint of the reclamation shape?	N	N	Y	N	N	N	N	N	N	N	N	N
	Are ecologically important designated sites (including Local Plan provisions) present within 500m of the site?	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Archaeology (terrestrial and marine)	Are scheduled archaeological areas or sites present within the footprint of the proposed reclamation shape?	N	N	N	N	N	N	N	N	N	N	N	N
	Are known archaeological deposits present within the footprint of the proposed reclamation shape?	?	N	Y	Y	Y	N	N	N	N	N	N	N
	Have archaeological artefacts been discovered in the past within the footprint of the proposed reclamation shape?	Y	N	Y	Y	Y	N	N	N	Y (WWII)	N	N	N
	Does the proposed site have archaeological potential (based on published data and confirmed anecdotal evidence of past discoveries in the area)? [Equivalent to Class E AEI]	Y	Y	Y	Y	Y	N	N	N	N	N	N	N
	Are designated or known archaeological sites (included in NPI) present or archaeological artefacts found in the past within 500m of the proposed reclamation shape?	Y	Y	Y	N (700m)	N (1 km)	N	Y	Y	Y (WWII)	Y	Y	N
Ornithology	Are known nesting sites for protected bird species present within 500m of the proposed reclamation site?	Y	(N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

		Area 1					Area 3						
		Reclamation Shapes					Reclamation Shapes						
Topic	**Criterion**	**1a**	**1b**	**1c**	**1d**	**1e**	**3a**	**3b**	**3c**	**3d**	**3e**	**3f**	**3g**
	Are known nesting sites for other bird species present within 500m of the proposed reclamation site?	Y	(N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are known feeding areas for protected bird species present within the footprint of the reclamation shape?	N (shore)	N	Y	N (shore)	N (shore)	N	N	N	N	N	N	N (shore)
	Are known feeding areas for other bird species present within the footprint of the reclamation shape?	N (shore)	N	Y	N (shore)	N (shore)	N (shore)	N (shore)	N (shore)	Y (outfall)	Y (outfall)	N (shore)	N (shore)
	Are known feeding areas for protected bird species present within 500m of the reclamation shape?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are known feeding areas for other bird species present within 500m of the reclamation shape?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are flyways used by protected bird species present within 1 km of the reclamation shape?	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)
	Are flyways used by other bird species present within 1 km of the reclamation shape?	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)	Y (in strong winds)
Geo-environmental	Are designated geological sites present within the footprint of the reclamation shape?	N (shore)	N	Y	N (shore)	N (shore)	N	N (shore)	N (shore)	N	N (shore)	N (shore)	N
	Are designated geological sites present within 500m of the site?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are other important (but not designated) geological sites present within the footprint of the reclamation shape?	?	?	?	?	?	?	?	?	?	?	?	?
	Are other important (but not designated) geological sites present within 500m of the site?	?	Y	?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Water Quality	Will the development of the reclamation shape hinder the water body from meeting the objectives specifically set for it under the Water Framework Directive?	Y?	Y?	Y?	Y?	Y?	N?	N?	N?	N?	N?	N?	N?

		Area 1					Area 3						
		Reclamation Shapes					Reclamation Shapes						
Topic	**Criterion**	**1a**	**1b**	**1c**	**1d**	**1e**	**3a**	**3b**	**3c**	**3d**	**3e**	**3f**	**3g**
Conflicts with other uses within the footprint of the Reclamation Shapes	Will the reclamation shape lead to conflicts (or intensify existing ones) with the recognised recreational areas within the footprint of the Reclamation Shapes?	Y	N?	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
	Will the reclamation shape lead to conflicts (or intensify existing ones) with shipping activities?	N	N?	N	N	N	N	N	N	Y? (GH approach)	Y? (GH approach)	N	N
	Will the reclamation shape lead to conflicts (or intensify existing ones) with commercial fishing activities?	N	N	N	N	N	N	N	N	N	N	N	N
	Will the reclamation shape lead to conflicts (or intensify existing ones) with salt harvesting activities?	N	N	N	Y?	Y?	Y?	Y?	Y?	N	Y?	Y?	N
People / Community / Settlements	Will the reclamation shape negatively affect the landscape quality of the area?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Will the reclamation shape negatively affect the visual amenity of the area?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Will the development of the reclamation shape disturb adjacent settlements or communities through dust, noise, traffic, etc?	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N

Key: 'Y' Impact considered likely, 'N' impact not considered likely; '**?**' Impact uncertain

Table 15-2: Impact of Afteruses

			AFTERUSE											
			Passive development		Mixed use	Tourism and Recreation					Industry and Environmental Infrastructure			
Topic	**Criterion**	**Reclamation shape**	**Nature sanctuary**	**Parkland for informal recreation**	**Residential, commercial, leisure**	**Hotel and resort development**	**Golf courses**	**Beaches**	**Marinas**	**Scuba diving**	**Port-related activities**	**Industrial activities**	**Desalinisation plants**	**Waste treatment facilities**
Ecology (marine & terrestrial)	Will the afteruse affect ecologically important designated sites (including Local Plan provisions) present within 500 metres of the reclamation shape?	1a	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y+	Y-	Y-	Y-	N
		1b	None	None	None	None	None	None	None	None	None	None	None	None
		1c	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		1d	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		1e	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		3a	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		3b	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		3c	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		3d	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		3e	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		3f	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
		3g	Y-	Y-	Y-	Y-	Y-	Y-	Y-	Y	Y-	Y-	Y-	Y-
Archaeology (terrestrial and marine)	Will the afteruse affect designated or known archaeological sites (included in NPI) present or archaeological artefacts found in the past within 500m of the proposed reclamation shape?	1a	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		1b	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		1c	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		1d	None	None	None	None	None	None	None	None	None	None	None	None
		1e	None	None	None	None	None	None	None	None	None	None	None	None
		3a	None	None	None	None	None	None	None	None	None	None	None	None
		3b	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		3c	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		3d	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		3e	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		3f	N	N	N	N	N	Y?	N	Y-	N	N	N	N
		3g	None	None	None	None	None	None	None	None	None	None	None	None
Ornithology	Will the afteruse affect known nesting sites for protected and other bird species present within 500m of the proposed reclamation site?	1a	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		1b	None	None	None	None	None	None	None	None	None	None	None	None
		1c	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		1d	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		1e	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3a	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3b	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3c	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3d	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3e	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3f	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3g	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
	Will the afteruse affect known	1a	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		1b	None	None	None	None	None	None	None	None	None	None	None	None

			AFTERUSE											
			Passive development		Mixed use	Tourism and Recreation					Industry and Environmental Infrastructure			
Topic	**Criterion**	**Reclamation shape**	**Nature sanctuary**	**Parkland for informal recreation**	**Residential, commercial, leisure**	**Hotel and resort development**	**Golf courses**	**Beaches**	**Marinas**	**Scuba diving**	**Port-related activities**	**Industrial activities**	**Desalinisation plants**	**Waste treatment facilities**
	feeding areas for protected and other bird species present within the footprint of the reclamation shape?	1c	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		1d	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		1e	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3a	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3b	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3c	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3d	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3e	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3f	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
		3g	Y+	Y+	Y-	Y-	Y+	Y-	N	N	Y-	Y-	N	N
	Will the afteruse affect flyways used by protected or other bird species present within 1 km of the reclamation shape?	1a	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		1b	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		1c	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		1d	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		1e	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		3a	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		3b	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		3c	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		3d	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		3e	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		3f	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
		3g	Y+	Y+	Y-	Y-	Y+	N	N	N	Y-	Y-	N	N
Geo-environmental	Will the afteruse affect designated or other important geological sites present within 500m of the site?	1a	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		1b	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		1c	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		1d	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		1e	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		3a	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		3b	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		3c	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		3d	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		3e	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		3f	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
		3g	N	N	N	N	N	Y?	Y?	N	Y?	Y?	N	N
Water quality	Will the afteruse hinder the water body from meeting the objectives specifically set for it under the	1a	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		1b	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		1c	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		1d	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		1e	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		3a	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?

			AFTERUSE											
			Passive development		Mixed use	Tourism and Recreation					Industry and Environmental Infrastructure			
Topic	**Criterion**	**Reclamation shape**	**Nature sanctuary**	**Parkland for informal recreation**	**Residential, commercial, leisure**	**Hotel and resort development**	**Golf courses**	**Beaches**	**Marinas**	**Scuba diving**	**Port-related activities**	**Industrial activities**	**Desalinisation plants**	**Waste treatment facilities**
	Water Framework Directive?	3b	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		3c	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		3d	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		3e	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		3f	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
		3g	Y?	Y?	Y?	Y?	Y?	N	Y?	N	Y?	Y?	Y?	Y?
People / Community / Settlements Water quality	Will the afteruse negatively affect the landscape quality / visual amenity of the area?	1a	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		1b	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		1c	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		1d	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		1e	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		3a	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		3b	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		3c	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		3d	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		3e	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		3f	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
		3g	N	N	Y?	Y?	N	N	Y?	N	Y?	Y?	Y?	Y?
	Will the afteruse disturb adjacent settlements or communities through dust, noise, traffic, etc?	1a	None	None	None	None	None	None	None	None	None	None	None	None
		1b	None	None	None	None	None	None	None	None	None	None	None	None
		1c	None	None	None	None	None	None	None	None	None	None	None	None
		1d	None	None	None	None	None	None	None	None	None	None	None	None
		1e	None	None	None	None	None	None	None	None	None	None	None	None
		3a	Y		Y		Y		Y		Y		Y	
		3b	Y		Y		Y		Y		Y		Y	
		3c	Y		Y		Y		Y		Y		Y	
		3d	Y		Y		Y		Y		Y		Y	
		3e	Y		Y		Y		Y		Y		Y	
		3f	Y		Y		Y		Y		Y		Y	
		3g	None	None	None	None	None	None	None	None	None	None	None	None

Key: 'Y+' Yes positive impact, 'Y-' Yes negative impact, 'N' no impact; Y**?**' yes, mitigable; 'None' Not applicable

PART D

INTEGRATED ASSESSMENT, CONCLUSIONS AND RECOMMENDATIONS

16 Integrated Assessment

Overview

16.1 There is a waste stream which can be accommodated technically by construction of land reclamation. The area suitable for this in technical terms is limited to an area landward of the -20m contour. Beyond this technical risks associated with deep-water engineering are too great.

16.2 Within these water depths, there are also major environmental constraints in both Area 1 and Area 3. The most significant environmental constraint is the presence of *Posidonia oceanica* beds. This internationally valued habitat, designated as a 'priority habitat type' in Schedule 1 of the Flora, Fauna and Natural Habitats Protection Regulations, 2006 is present in most but not all of the areas within the -20m contour. There is a large area within Area 3 where there is no *Posidonia oceanica*. This area therefore is the most preferable area for land reclamation. Of course, there are numerous other environmental issues, which need to be taken into account, and it is possible that if a more detailed site investigation and site–specific environmental assessment is undertaken that a fundamental constraint on developing in this area will be identified. Nonetheless, based the work carried out to date, and the current state of knowledge, the northern end of Area 3 is the only area which is technically feasible with acceptable risk, and not in conflict with a major European environmental designation.

16.3 Other important environmental constraints include the occurrence of *Cymodocea nodosa* communities in the majority of the proposed reclamation shapes, the presence of locally-breeding species of avifauna and feeding areas for protected bird species, the high archaeological potential of the seabed in both Areas 1 and 3, and the coastal areas abutting the proposed reclamation areas which are scheduled or listed as Areas of Ecological / Geological Importance, Sites of Scientific Importance and / Area of High Landscape Value. Several sectoral policies in the Structure Plan are relevant to reclamation in Areas 1 and 3; particularly important is the key target of the plan to contain urban sprawl within the development boundary defined by the 1988 Temporary Provisions Schemes and the Primary Development Areas. The application of policies in the Coastal Strategy Topic Paper, in particular the promotion and protection of public access to the coast, are likely to affect the feasibility of reclamation projects. The latter are also likely to be incompatible with the Local Plans policies that protect the natural and cultural heritage of the coastal zone.

16.4 The principal impacts of construction of reclamation areas include increased turbidity of the water column, direct loss of benthic environments beneath the reclamation, smothering of benthic habitats from the settlement of suspended particles, changes in currents and hydrodynamic regime, discharge of silt-laden stormwater, noise, vibration and emissions to air and the direct loss of terrestrial geology.

16.5 The potential environmental impacts arising from afteruse development include the following:

- Concentrated stormwater discharge, noise, emissions and traffic arising from all afteruses;
- Passive development may result in the expansion of existing terrestrial protected habitats and species and an increase in their appreciation by the public;
- Increased recreational use of the sea in the vicinity of each of the reclamation shapes, and particularly scuba diving (if unregulated) could result in the loss of cultural artefacts from the seabed;
- Marinas and beach development are likely to locally reduce water currents thus affecting siltation and flushing of pollutants;
- Nesting areas, feeding areas and flyways could be detrimentally affected by the development of urban afteruses, but positively impacted by the development of the passive afteruses and golf courses;
- Nesting areas, feeding areas and flyways could be detrimentally affected by the development of urban afteruses, but positively impacted by the development of the passive afteruses and golf courses;
- Water quality could be affected to a minor extent by urban discharges (e.g. from roads and other hard surfaces), and from discharges / antifouling associated with shipping and industrial uses. Discharges to air and sea from facilities such as desalination plants, and waste processing plants (either STP or biowaste facilities) are likely to affect both air and water quality;
- Afteruses that involve shipping and port-related activities could prevent the recreational use of the coast in the vicinity of the reclamation; and
- All urban afteruses are likely to affect the visual amenity and landscape value of the area.

16.6 The area free of *Posidonia oceanica* within Area 3 is sufficiently large that it could accommodate a wide variety of specific footprint shapes and locations. Of the possible land reclamation shapes considered in the assessment of technical and economic feasibility, shapes 3d and 3e fit into the available area. Shapes 3f fits apart from a small area at its southern end. Shapes 3a, 3b and 3c do not fit in their entirety, but approximately two-thirds of each shape does.

16.7 Therefore in terms of environment, feasible approaches could include shape 3d alone with a capacity of 5 million m^3, shape 3e alone with a capacity of 10 million m^3, a slightly truncated shape 3f almost 20 million m^3, or a modified version of 3a, 3b or 3c with a volume of 3.5 million m^3 to 14 million m^3. The precise footprint could be refined and optimised to allow for smaller scale environmental constraints or technical issues. The size of the reclamation could be optimised in terms of the volume of waste material which is available. However, at the present stage of the development of the project this means that the economics of all shapes 3a to 3f are all relevant.

16.8 Economically there are significant differences between the shapes. As shown in Chapter 13, shapes in Area 1 (with the exception of shape 1b which is an island), are generally more cost-effective than shapes in Area 3 for non-development options and produce higher rates of return for development options.

16.9 The economic analysis suggests that within Area 3, shapes 3a, 3b and 3e are best in terms of development options. Given the rather small scale of a truncated shape 3a the logical preferred shape would be either a shape 3e with a volume of 10 million m^3 or a truncated shape 3b with a volume of around 7 million m^3.

16.10 For non-developed options, the best shapes are truncated 3b, 3c and 3f, with capacities ranging from 7 million m^3 to about 18 million m^3.

16.11 Taking both undeveloped and developed options together, the preferred location for reclamation would be the northern part of Area 3, with a precise footprint optimised to suit the need so the development and environmental and any other constraints.

16.12 This location also has the advantage of being adjacent to the general area of the Smart City Malta regeneration. This raises the possibility of synergy being found between the regeneration and the reclamation – for example the proposed disposal of construction waste from Smart City Malta could go directly to the reclamation. The Smart City development includes provision for road construction which would help ease the traffic and construction noise issues that would arise from movement of waste material to form the reclamation. Equally, as the Smart City plans are well advanced it is necessary to ensure that plans for reclamation do not adversely affect Smart City Malta.

16.13 The northern part of the available area also has a history of placement of construction waste at the coast, so the land reclamation proposal would be less of a policy departure in this area.

16.14 The area available in Area 3 is relatively long and narrow, and does not lend itself to a wide variety of complex reclamation shapes such as islands. The basic shape will need to be somewhat rectilinear. However, it would be possible to create a channel between mainland and reclamation if that was deemed to create a more valuable or more easily saleable development.

16.15 It would also be possible to create a marina as part of the development. To provide protection against the wave climate, the entrances to the marina would need to be well protected by overlapping breakwaters.

17 Conclusions

Waste Stream

17.1 Mean annual production of inert waste is between 2.1 and 3.3 million tonnes, largely comprised of unwanted excavation arisings of soft limestone known as Globigerina. Approximately 0.9 million tonnes is recycled, leaving a net annual production of unwanted inert waste of 1.2 to 2.4 million tonnes.

17.2 The bulk of this material is deposited in licensed quarries, but a substantial part is deposited in unlicensed quarries. A smaller element, about 0.2 million tonnes is dumped at sea in licensed areas.

17.3 The information on the characteristics and quantities of the stream is limited due to lack of officially collected data at source or disposal. All quantities are estimated and therefore have to be treated with caution. There is no reliable information on whether the annual production is increasing with the general expansion of the economy.

17.4 There are some prospects of increased recycling of inert waste and of reduced production due to more efficient excavation methods, however it would not be prudent to rely on these developments solving the problem of what to do with the waste.

17.5 There are no current proposals to increase taxation on inert waste disposal, which might be considered as one way of encouraging greater use of recycling.

17.6 The figures on current availability of land storage in disused and live quarries suggests a capacity of 15 years, but the reliability of these figures is open to question, particularly as any disposal location is the subject of negotiation between government and private owners and therefore capacity may be influenced by financial incentives offered.

Technical Feasibility

17.7 Land reclamation using the waste material is technically feasible providing it is bunded and contained. Without containment, placed material would be subject to rapid erosion and dispersion across large areas, which would be environmentally acceptable. Bunding would take the form of a breakwater, constructed by one of a number of methods including rubble mound, concrete caissons and steel caissons.

17.8 Technical difficulties of bund construction effectively restricts the feasible area for reclamation to areas of the sea bed shallower than 20m deep – i.e. areas within the -20m contour. Beyond this there is very little experience of land reclamation and construction of breakwaters and costs and risks increase rapidly.

17.9 There is no apparent case for construction of submerged land, expect perhaps in the form of reefs to aid fishing. However these would not absorb a significant part of the waste stream or produce an obvious commercial return.

17.10 There is no obvious reason for island creation as opposed to land extension, and the physical nature of the seabed in Areas 1 and 3 limits possible islands to Area 1 only. Creation of an island would involve greater costs, and would lead to construction in deeper water incurring high risks. Reclamation would most logically be constructed by end tipping of trucks to create a contiguous land extension rather than an island.

17.11 A total of 11 indicative land reclamation shapes were identified, giving a range of waste acceptance capacities from 1.8 to 20 million m^3, assuming the objective is to develop land at minimal cost. This would require a fill level of about 5 metres above sea level. If these shapes were not developed with an afteruse, but were instead filled to a level of 25 metres above datum, then the capacities would range from 4.7 million m^3 to 46 million m^3.

17.12 The shapes have surface areas ranging from 17 to 129 ha.

17.13 The 11 shapes are not a definitive list of possible reclamation options, as there are many variations that could be applied, but do provide an 'envelope' of possible shapes that together provide an overall approach to land reclamation – in effect the optimum shapes can be created from one or more of these shapes in combination, or by some modification of the shapes.

Costs

17.14 Costs were established for each reclamation shape, using a combination of Maltese experience and experience from marine projects worldwide. The present value cost of creating the reclamations was assessed as ranging from €42 million to €546 million using a public sector discount rate of 5%.

17.15 Costs vary according to the volume of fill that would need to be placed, the length and cross-section of bunding structure required to contain the fill, and the cost of preliminary studies and investigations. Where reclamation shapes require construction of bunds in relatively deeper water, or a large length of bund (for example in the case of an island) then the costs increase significantly, particularly in the early stages of the project.

Infrastructure Requirements

17.16 Infrastructure in this context means the roads, drainage, utilities etc. required to make the reclamation developable. It does not include provision of services to individual plots, but provision to the reclamation and provision of a 'spine' from which services can later be provided to individual plots. Infrastructure requirements were assessed in a largely generic way for both Areas 1 and 3. Detailed requirements could not be evaluated at his stage of project development, because the size and nature of the development, particularly its after-use, has not been determined. Nonetheless an initial appraisal has been made. In principle, infrastructure issues and costs will not be a determining factor in the feasibility of the project. These are significantly outweighed by costs of reclamation construction.

Implementation

17.17 Implementation of a significant land reclamation project would take of the order of 5 years to study and design, and to take through the planning and EIA process.

17.18 A project of this type raise a large number of questions about how it would be funded and managed, what contract forms would be used, how ownership would be dealt with and so on. Because of its unique nature, there is no well-defined optimum model to follow. These issues would need to be studied in more detail if the project was to be taken forward.

Economic Assessment

17.19 A number of possible land reclamation shapes were assessed economically. The assessment has included looking at:

- The cost per m^3 of fill material placed in a reclamation as a comparator to costs for fill placed in quarries or dumped at sea;
- How costs per m^3 of fill material placed vary with the level to which fill is placed;
- What return a private sector project to create land from land reclamation would generate, assuming the land was suitable for development;
- What return the public sector would get from a project to create the land and develop it; and
- The benefits to the economy of a project to create the land and then develop it.

17.20 Because of the differing timescales for the various land reclamation shapes, this was undertaken using discounted cash flow methods with suitable discount rates. It was found that:

17.21 The cost of placement per m^3 ranges from €15 to €40, compared to around €3 for placement in quarries and €4 for dumping at sea, so land reclamation is a more costly approach. If the filling level is raised to +25 metres, this reduces costs to €9 to €28. Because more fill can be accommodated for a given area. This is still more than the cost for placement in quarries.

17.22 A suitable rate of return for a private sector project to be viable (around 15%) would only be achieved by some of the land reclamation shapes, generally those with shorter timescales for completion and located in shallower water depths. Most of these are within Area 1, some within Area 3. Islands would not be viable.

17.23 In terms of impact on the economy of Malta, a land reclamation project would generate present value benefits of between €616 million and €3180 million and produce a rate of return of 10-40%. The highest returns would be achieved by reclamations in shallower waters, typically those in Area 1. It would therefore meet government investment criteria.

However, this conclusion is dependent on the land being subsequent developed along lines similar to the proposals for SmartCity. Smart City has been evaluated as producing net annual benefits to the economy of up to €800 per square metre. There remains a question mark over whether there is sufficient demand for this scale of development. This would need to be the subject of a more detailed assessment, possibly with direct dialogue with potential developers.

Environment and Legal Issues

17.24 A baseline environmental assessment has been made of Areas 1 and 3. This has included a combination of desk studies, numerical modelling and field investigations. The programme of work to support the environmental assessment has been substantial, with the following included:

- Sea bed surveys of seagrass bed extent and quality, using divers and remotely operated vehicles down to depths of 40 metres;
- Field measurement of currents;
- Desk studies of fishery issues, birds, archaeology;
- Numerical modelling of currents
- Assessment of wave climate and numerical modelling of wave action along the coast

17.25 An initial assessment of environmental issues related to land reclamation in Areas 1 and 3 has been made. This work has included:

- dispersion of sediments from disposal sites;
- footprint of land reclamation in relation to protected habitats; and
- a review of relevant plans, policies and legal issues

17.26 The key environmental baseline data from Areas 1 and 3 includes the following:

Area 1

- The majority of the proposed reclaimed areas in shapes 1b, 1d, and 1e, and about 50% of the proposed reclaimed areas in shapes 1a and 1c, coincide with *Posidonia oceanica* communities. All reclamation shapes in Area 1 also coincide with infralittoral algal communities and *Cymodocea nodosa* communities. Additionally, all reclamation shapes in Area 1, apart from reclamation shape 1b, are within 500m of an ecologically important designated site. Reclamation shape 1c also includes an ecologically important designated site within its footprint.
- Area 1 has a high archaeological potential. Archaeological objects recovered from Area 1 include Roman shards, two Roman anchors, a Roman corn grinder, a ballast heap, and amphora necks from the late Roman or early Byzantine periods.

- Locally-breeding species of avifauna recorded in Area 1 include the Short-toed Lark, Zitting Cisticola, Sardinian Warbler and Spanish Sparrow. Quail and Short-eared Owls have also been recorded flying in the area. Movements of Cory's Shearwater, Yelkouan Shearwater, Great Cormorants and Gulls have been recorded within and offshore Area 1. A feeding area for protected bird species is only found in the footprint of reclamation shape 1c. Feeding areas for other bird species are found within the footprint of reclamation shape 1c. In strong winds, flyways within 1 km of all reclamation shapes are used by protected and other bird species.
- The coastal area abutting Area 1 consists of karstland supporting marine garrigue and is thus of high ecological, scientific, and scenic importance.

Area 3

- The majority of the proposed reclamation areas in shapes 3a, 3b, 3c, 3d, 3e, and 3f coincide with infralittoral algal communities. Reclamation shapes 3a, 3b, 3c, 3f and 3g also coincide with *Posidonia oceanica* communities.
- Locally-breeding species of avifauna recorded in Area 3 include the Short-toed Lark, Zitting Cisticola, Sardinian Warbler, Spanish Sparrow, Common Swift and Tree Sparrow. Quail and Short-eared Owls have also been recorded flying in the area. Movements of Cory's Shearwater, Yelkouan Shearwater, Storm Petrels, Single Gannets, Great Cormorants and Gulls have been recorded within and offshore Area 3. Bird species congregate to feed over the sewage outfall in Area 3. In strong winds there are flyways used by protected and other bird species within 1 km of all reclamation shapes.
- The archaeological potential of Area 3 is high. The main archaeological 'objects' discovered on the seabed of Area 3 or within its vicinity consists of a series of modern wrecks datable to the Second World War: Schnellboot S-31, HMS St Angelo, HMS Eddy, The Hellespont and HMS Southwold.
- The coastal area and valleys within the Ricasoli / Kalkara area are scheduled or listed as Areas of Ecological / Geological Importance and Sites of Scientific Importance in the respective Local Plans. Part of the Ricasoli peninsula coincides with a scheduled Area of High Landscape Value.

17.27 *Posidonia oceanica* beds are listed as a 'priority habitat type' in Schedule I of the Flora, Fauna and Natural Habitats Protection Regulations, 2006[80]. *Cymodocea nodosa* beds are listed in Schedule III of the Flora, Fauna and Natural Habitats Protection Regulations, 2006. Large shallow inlets and bays, and reefs in Area 1 are also listed under these Regulations.

17.28 The relevant environmental legislation and legal implications include the following:

- It is important to obtain a confirmation from the Competent Authority that the

[80] LN 311 of 2006; this transposes the EU Habitats Directive into local legislation.

material to be used for land reclamation is not considered to be waste and therefore the provisions of Legal Notice 337 of 2001 do not apply, and to change Legal Notice 128 of 1997 to allow for placement of matter on the seabed as in land reclamation operations.

- The Structure Plan does not give guidance on land reclamation as such. However, projects that involve extension of beaches would require detailed studies. There are other sectoral policies within the Structure Plan that are applicable to Areas 1 and 3, although they do not concern land reclamation *per se*. These policies regard:
    - Settlement Pattern (SET and HOU): A key target of the 1992 Structure Plan was to contain urban sprawl within the development boundary defined by the 1988 Temporary Provisions Schemes and the Primary Development Areas;
    - Built Environment (BEN);
    - Tourism & Recreation (TOU, REC);
    - Transport (TRA);
    - Conservation (RCO, MCO, CZM); and
    - Public Utilities.
- The Coastal Strategy Topic Paper directs development in accordance with the objectives of protecting coastal and marine habitats and biodiversity, protecting cultural heritage, protecting coastal uses that necessitate a coastal location, promoting and protecting public access and use and minimising existing and potential user conflicts. The application of the policies is likely to detrimentally affect the feasibility of reclamation projects.
- The Waste Management Subject Plan is only relevant to the land reclamation insofar as the material that would be used for the reclamation, predominantly Globigerina Limestone, is currently generally considered to be inert waste and not a resource.
- Central Malta Local Plan: Depending on their extent, land reclamation projects on the coastline immediately adjacent to Ghallis / Bahar ic-Caghaq are highly likely to be incompatible with the requirements of Policy NA04.
- Grand Harbour Local Plan: Two policy areas are relevant to the feasibility of land reclamation in Area 3: the protection of natural heritage, and the designation of a site for public works. Additionally, according to the Local Plan, much of Area 3 should be subject to a coastal zone management programme.
- South Malta Local Plan: Policies SMCO 3 and SMCO 7 (presumption against development that would affect Areas of Ecological Importance / Sites of Scientific Importance and Valleys), are relevant to the feasibility of land reclamation in Area 3.

17.29 It was concluded that the major environmental issue is the presence of protected seagrass habitats over much of the seabed within the -20m area. This habitat is protected under EU

law, and only a development of national importance would justify construction in this area. It is concluded that land reclamation for the purpose of accommodating inert waste and creating land for development is not of sufficient national importance for the project to go ahead.

17.30 Therefore it was concluded that only the areas without seagrass beds should be considered further for land reclamation. This limits land reclamation to the northern part of Area 3.

Overall Conclusions

17.31 Assuming that a land reclamation project was to be progressed, then the preferred location for land reclamation is the northern part of Area 3. This is the only area which satisfies all technical constraints and (subject to EIA) meets the most critical of the identified environmental constraints. The initial economic analysis is also reasonably favourable, particularly in terms of a public sector project. In principle, land reclamation in this area is therefore a ***realistic*** option**.**

17.32 Negative impacts of an urban type development are likely to be greater than that for a passive type development such as parkland or nature sanctuary,

17.33 The degree to which the project would be attractive to the private sector is considered limited at present. Although a project in Area 3 has the potential to achieve the required rate of return to make investment attractive, the combination of rather marginal returns with risks associated with lack of security of material supply, as described below, probably make the project unattractive to the private sector.

17.34 The level of government spending which would be required to take a project forward is (for all but the smallest options) considered very large- in the order of hundreds of millions of euros. It would appear prudent to attempt to improve the understanding of the waste stream, and consider other measures to reduce the size of that stream, before embarking on such as high cost project.

17.35 There is also some uncertainty in the demand for afteruses to support land reclamation on the large scale that would be the case for any project.

17.36 There is uncertainty in terms of government approach to waste taxation and other factors which might in the future affect the need for the project. There is a question over whether changes in taxation and waste polices might help drive the amount of material generation down and recycling up to reduce the demand for disposal capacity and increase the time horizon before new capacity is required.

17.37 The data on the waste stream, which provides a significant motive for land reclamation and the material required, is somewhat unreliable. Although there is clearly a stream of material which is surplus to requirements, it is not entirely clear what the volume of this stream is, nor how it will change in the future. The expansion of the Freeport at Marsaxlokk Bay could provide an alternative means of accommodating inert waste.

17.38 Therefore the land reclamation project should only go ahead if there is no other possible means of dealing with the material being generated, and all quarry space has been exhausted. If there is a period of many years before that situation arises, then it would be logical to concentrate on improving the effectiveness of existing policy and economic instruments to reduce inert waste generation rather than going directly to land reclamation. In tandem with this, further work is required to fill the identified data gaps to support a project go-ahead. This should take the form of high level studies, together with enhanced collection of waste data over a period of 2 or more years to further substantiate the figures. A site-specific feasibility study, based on the northern part of Area 3, would follow if the high-level studies produced positive findings. Recommendations are set out in Chapter 18.

18 Recommendations

18.1 The project should be taken forward by a combination of site specific studies to develop a land reclamation option in more detail, and high-level studies looking at other aspects of the waste generation situation:

High-level Studies and Data Collection

18.2 These would include:

- Assessment of alternative procurement and investment approaches, resolution of private/public ownership issues, identification of responsible authority to take the project forward. This task encompasses all the investigations and decisions required to arrive at a robust approach to who will take responsibility for the project in government, how the project will be funded, how it will be delivered and how the land created will be developed and who it will be owned by. There are obviously some parallels to draw from in Malta, such as the Freeport and the Smart City project. There are also models from international experience, such as the inert waste reclamation in Jersey, and the large reclamations in Dubai and, Bahrain. Each of these has a different approach.

- Review and resolution of issues related to ensuring material supply, in the context of waste management policies and mechanisms for waste reduction, the taxation regime, renewal of land filling contracts etc. In order for the project to be secure, the supply must be maintained which means the project must have some level of governmental 'protection' against adverse impacts which could arise from changes in legislation, licensing agreements or taxation policies.

- Measures to improve reliability of waste stream data, through monitoring, source and disposal correlation, questionnaires of industry implemented over a 2 or more year period to provide unequivocal waste stream data.

- Review of alternative space data from quarries.

- Consultation on alternative disposal options and recycling and introduction of new excavation techniques.

18.3 Providing that the above studies produced a positive finding, then the project would advance to site-specific studies as set it below.

Site-specific Feasibility Study

18.4 A Site-specific feasibility study should focus on the northern part of Area 3 for reclamation and fully explore the issues associated with reclamation at these sites. A programme of work should include:

- Detailed evaluation of wave climate at sites to support an outline design of edge

protection and a risk-based assessment of alternative construction approaches. Evaluation of wave climate is likely to include both desk-based methods and an element of site-specific field data collection;

- Preparation of a phasing plan identifying programme for each phase, to enable construction planning and to support the economic assessment;
- More detailed construction costings. In order to make costings as accurate as possible, both local and major international contractors would be consulted (without any commitment) to verify rates.
- Preparation of a conceptual master plan for the development, to support the assessment of economics for the development and the costing of infrastructure requirements;
- Detailed economic and financial assessment for the proposed sites, taking into account the more realistic phasing plan, nature of the sites , information on demand and land values at these locations and identifying whether the project is beneficial to the country and viable as an investment opportunity for others;
- Site-specific assessment and costing of infrastructure requirements, linked to a realistic and agreed master plan concept;
- Site-specific baseline environmental surveys and outline EIA
- Preparation of a risk register, with identification of risk percentages, outturn impacts (on programme and costs) and mitigation measures.
- Investigation of geotechnical properties of the seabed at the sites, to ascertain suitability for the proposed works and engineering parameters such as bearing capacities, likely consolidation rates, and need for removal of any soft sediment layers.
- Site survey, including both seabed levels and adjacent land topography. The marine survey would probably include measurement of currents and water levels and wave heights and directions;

18.5 The results from these studies would be a report setting out a site-specific assessment of the project, its costs, risks, economics, finances and environmental issues. The timescale for this phase would be about 12 months.

Detailed study, EIA and planning

18.6 This phase would take the project from feasibility to completion of designs and all planning requirements. It would include:

- Design of reclamation and edge protection, with full drawings and specifications. A client's preferred design would be produced, as a basis for costing, phasing and risk assessment. However, normally alternatives to this would be allowed providing that the alternatives meet the performance specifications.
- Design of infrastructure, with full drawings and specifications;

- Preparation of contract documents for a selected preferred procurement approach. This would involve a number of contracts, both for the construction phase and for the investment/ownership aspects, including responsibilities for maintenance, arrangements for land sales and post-construction ownership;
- An agreed master plan for the development;
- A full EIA or Environmental Statement, to support a planning application. The EIA/ES would include proposals to monitor and mitigate impacts associated with construction such as traffic, noise, control of materials deposited into the water column, protection of habitats etc. For a project of this size it would almost certainly need to be accompanied by illustration media such as virtual images, fly-throughs, artist's impressions etc. and by a stakeholder engagement and consultation summary.

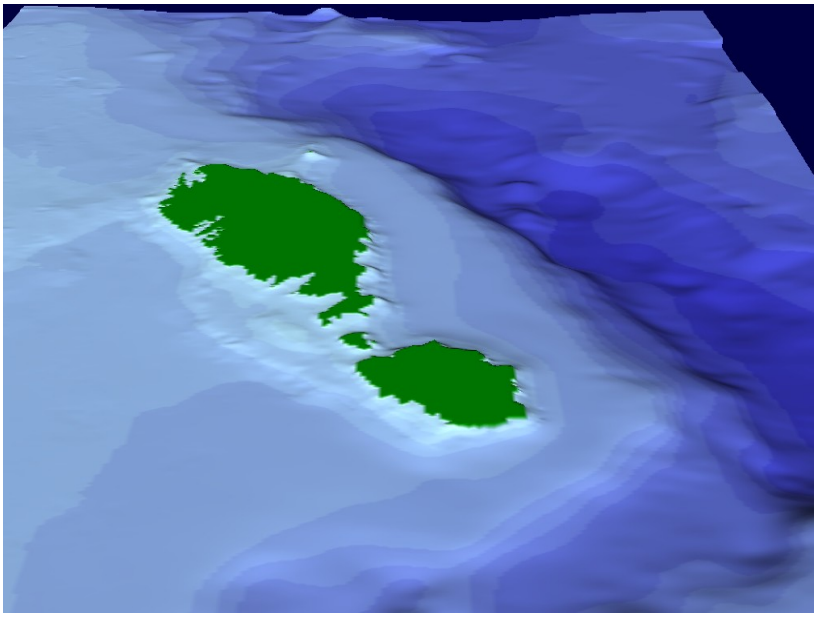
18.7 Including the planning process, this phase might take a further 12 to 24 months. At the end of the phase the responsible authority would have an implementable scheme.

Malta Environment and Planning Authority

Detailed Investigations and Feasibility Studies on Land Reclamation at Two Indicated Search Areas, Malta

Technical Report 2
Volume 2: Appendices

April 2008



Prepared for:

MEPA
MALTA ENVIRONMENT & PLANNING AUTHORITY

Revision Schedule

Technical Report 2 - Volume 2: Appendices
April 2008

Rev	Date	Details	Prepared by	Reviewed by	Approved by
01	Apr 08	For Client Approval	**Laura Mitchell** Engineer	**Russell Foxwell** Team Leader	**David Dales** Director

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www.scottwilson.com

Table of Contents

1 Introduction

1.1 The Malta Environment and Planning Authority (MEPA) has appointed Scott Wilson Ltd to carry out a feasibility study to determine whether reclamation of land from the sea is a realistic option for Malta. The Study is focused upon two specific search areas situated in Maltese waters and examines the issues related to the use of inert construction and demolition materials for reclamation, taking into account relevant technical, legal, environmental and economic factors.

1.2 The Study team is led by Scott Wilson, in association with Adi Associates Environmental Consultants Ltd, Ecoserv Ltd. and Titan Environmental Surveys Ltd.

The Study

1.3 The specific objectives of the Terms of Reference (which are centred on studies of the marine environment in two targeted areas) are two-fold:

i. To perform a detailed investigation of the marine environment in Area 1 and Area 3 as identified in the Project Identification Report; and

ii. In the light of the findings of (i) above, to carry out a feasibility study on the land reclamation options in the two areas.

1.4 The Terms of Reference divides the Study into two Components, as described below.

1.5 Component 1 comprises “A marine baseline survey, which enables an assessment of the present marine environmental conditions along with the carrying capacity of the marine environment. The marine survey should provide the basis for characterization of the marine environment with respect to environmental value in the context of designating protective zones under the EU habitat directive and identify the significant impacts on the environment of a large-scale marine structure in the area.”

1.6 Component 2 comprises “A detailed Feasibility Study describing the Land Reclamation process in sufficient detail to allow the decision makers to take a final decision on whether to go for land reclamation or not, in search areas 1 and 3.”

Scope of this Report

1.7 This report presents the Appendices to Volume 1 of Technical Report 2 and includes:

- Annex A: Stakeholder Workshop Information;
- Annex B: Analysis of Marina Demand; and
- Annex C: Discussion of Relevant Legislation.

2 Annex A: Stakeholder Workshop Information

2.1 A workshop was held on 6 September 2007 to inform stakeholders about the reclamation study and its aims. A presentation was given outlining progress with the Study followed by a discussion session, during which stakeholders were invited to provide feedback to improve the project team's understanding of the key concerns of stakeholders, constraints on reclamation in Malta and the potential local benefits that may arise from a reclamation scheme.

2.2 This Annex includes:

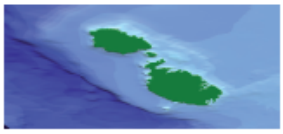
- Stakeholder workshop invitation;
- List of organisations invited to the stakeholder workshop;
- List of workshop attendees;
- Presentation given at the stakeholder workshop; and
- Notes taken during the discussion session.

Stakeholder Workshop Invitation

MEPA
MALTA ENVIRONMENT & PLANNING AUTHORITY

Land Reclamation Feasibility Study

A Stakeholder Workshop



MEPA cordially invites you to:

A Stakeholder Workshop:
Part of the Land Reclamation Feasibility Study

Thursday 6 September:
10.30am – 13.30pm

Venue:
Phoenicia Hotel

The objective of this study is to determine whether land reclamation is a realistic option in two specified areas along the coast of mainland Malta. The study requires consideration of the economic, technical, legal and environmental aspects of the potential land reclamation.

The aim of the workshop is to inform stakeholders about the reclamation study and its aims. Stakeholders will be invited to input into the study to improve the project team's understanding of the constraints on reclamation in Malta and the potential local benefits which may arise from a reclamation scheme.

Agenda:

- Opening and objectives of project
- What is land reclamation? Discussion of benefits and disbenefits
- Progress and investigation to date
- Discussions and feedback
- Closing summary

adi ASSOCIATES ENVIRONMENTAL CONSULTANTS

Stakeholder Invitees and Attendees

2.3 MEPA identified and invited the following organisations to the stakeholder workshop:

- Ministry For Rural Affairs And Environment
- Malta Maritime Authority
- WasteServ Malta Ltd
- Malta Centre for Fisheries Science
- Malta Tourism Authority
- Superintendence of Cultural Heritage
- Chamber of Commerce
- Ministry for Resources & Infrastructure
- Federation of Industry
- GRTU
- BICC
- Department of Public Health
- Malta Resources Authority
- ADT - Transport Authority
- Water Services Corporation
- Enemalta
- National Statistics Office
- Twinning Expert
- Nature Trust
- Birdlife Malta
- Din L-Art Helwa
- BICREF
- Naxxar LC
- M'Scala LC
- Xghajra LC
- St. Paul's Bay LC
- Kevin Mercieca (MEPA)
- Joe Gauci (MEPA)
- Frans Mallia (MEPA)

- Victor Sladden (MEPA)
- Sylvio Farrugia (MEPA)
- Godwin Cassar (MEPA)
- Chris Borg (MEPA)
- Andrew Calleja (MEPA)
- Dimitrio Duca (MEPA)
- Nature Protection Unit (MEPA)
- Land Reclamation Steering Group (MEPA)
- Director Environment Protection (MEPA)

2.4 The following people attended the workshop:

Name	**Agency**
Joseph Sciortino	Consultant
Danielle Calenti	BICREF
George Camilleri	Din L-Art Helwa
Paul Gatt	Naxxar Local Council
Anthony Valvo	Mayor Xghajra Local Council
Joseph Attard	GRTU
Charles Bonnici	Environmental Health Department
Andrew Vella	MRAE
Jeanelle Catania	Federation of Industry
Hans-Joerg Zerz	EU Twinning - RTA
Gabrielle Galea	Malta Maritime Authority
Johan Buttigieg	MEPA
Michael Sant	MEPA
Joseph Gauci	MEPA
Michelle Borg	MEPA
Donatella Vella	MEPA
Yvette Rizzo	MEPA
Odette Kerr	MEPA
Duncan Borg	MEPA
Denise Attard	MEPA
Louis Vella	MEPA
Vincent Magri	Wasteserv Malta Ltd
H. Petrula Caruana	Wasteserv Malta Ltd.
K Rizzo	Wasteserv Malta Ltd.
Rachel Xuereb	Adi Associates

Krista Falzon	Adi Associates
Kevin Morris	Adi Associates
Laura Mitchell	Scott Wilson

Workshop Presentation

Land Reclamation Feasibility Study Workshop

September 6 2007

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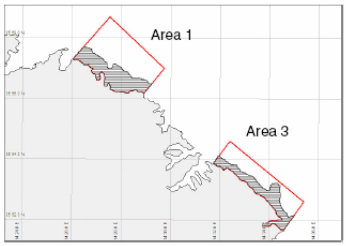
Purpose of Workshop

- Inform stakeholders of objective of study, progress to date, any interim findings
- Get stakeholder views and contributions to the study
- Please remember – the study is not complete, work is in progress!

Study Objective

- to determine whether land reclamation in the sea is a realistic option under consideration of technical, legal, environmental and financial aspects.
- in the context of current production of large of volumes of inert waste

Study Areas



Study Programme

- Commenced March 2007
- Programmed to complete by end of 2007

Study Outputs

- Technical Report 1: Baseline Conditions and Field Survey Reports
- Technical Report 2: Feasibility Report

Technical Report 1 – Contents

- Water Phase
  - Water quality
  - Salinity/temperature
- Hydraulics
  - Bathymetry
  - Currents
  - Winds and Waves
- Marine Archaeology
- Benthic Habitats
- Pelagic Species
- Ornithology
- Geology

Photos – Area 1

Photos – Area 1

Photos – Area 1

Photos – Area 1

Photos - Area 3


Photos – Area 3
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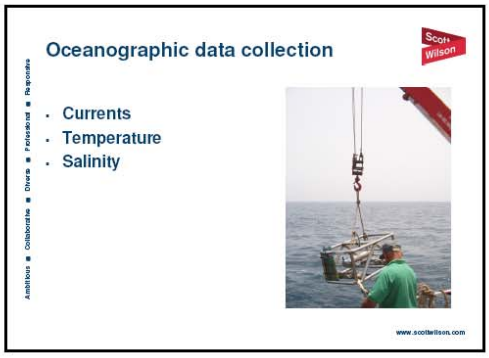
Oceanographic data collection
Currents
Temperature
Salinity
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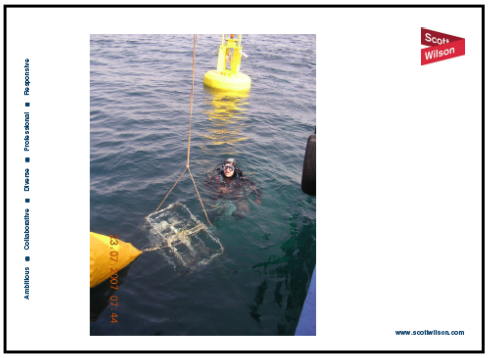
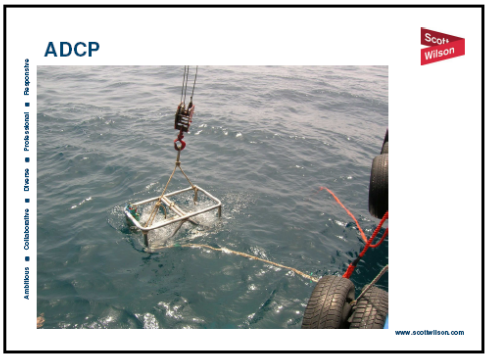
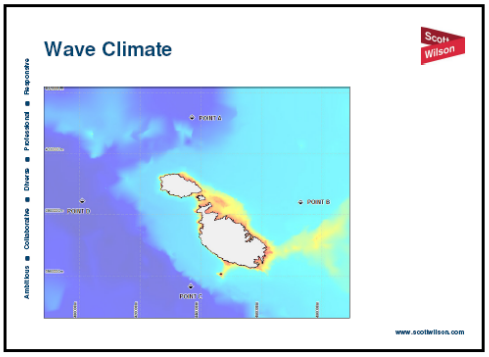
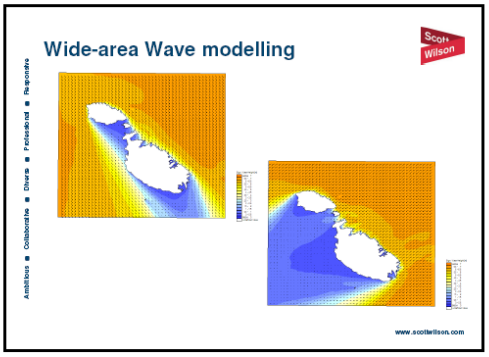
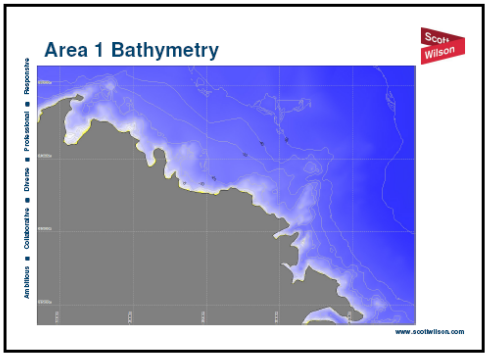
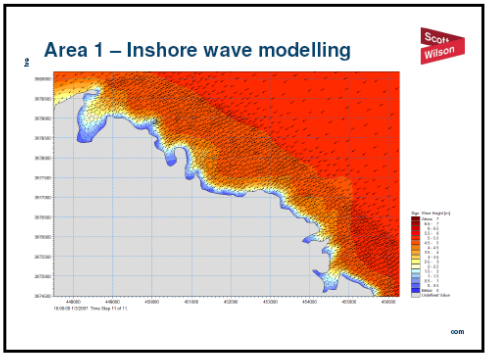



ADCP

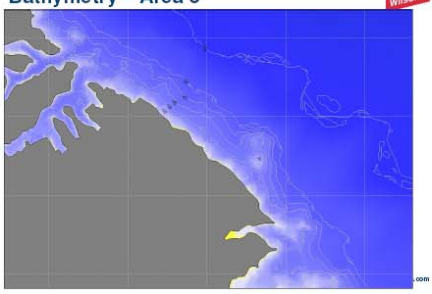

Wave Climate


Wide-area Wave modelling

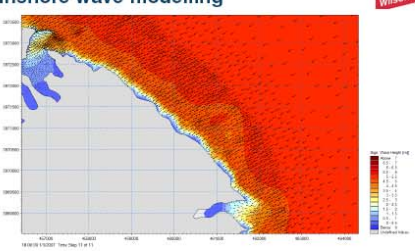

Area 1 Bathymetry


Area 1 – Inshore wave modelling

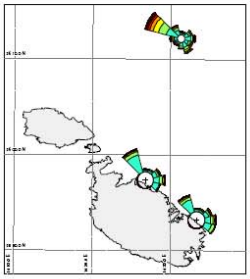
Bathymetry – Area 3



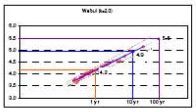
Inshore wave modelling



Wave climate



Wave heights



Return Period	Extreme Wave - Hs (m)	
(Years)	Area 1	Area2
1	4.0 - 4.3	4.1 - 4.4
2	4.3 - 4.6	4.4 - 4.8
5	4.6 - 4.9	4.7 - 5.1
10	4.7 - 5.2	4.9 - 5.4
25	4.9 - 5.4	5.1 - 5.7
50	5.1 - 5.6	5.3 - 5.9
100	5.2 - 5.8	5.4 - 6.0

Benthic Habitats

- Detailed survey of the seabed in Areas 1 and 3
- Identification of the different assemblages
- Two main techniques used:
  - Diver surveys (0 – 10m depths)
  - ROV surveys for deeper waters (11 – 50m)

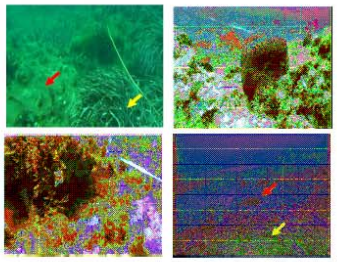
Benthos - progress

- Progress to date:
  - All Diver Surveys completed (Area 1 and 3)
  - ROV surveys in Area 1 completed
  - ROV Surveys in Area 3 starting
  - Anticipated fieldwork completion – mid-September
  - Analysis of video footage, mapping & reporting

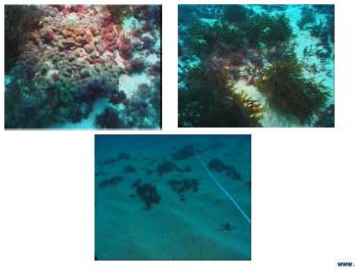
Benthos – Preliminary findings

- Area 1:
  - Bedrock 0-5m; extensive *Posidonia* meadows 6 – 34m; mobile sediments 35 – 50m
  - Areas close to Qalet Marku & Bahar ic-Caghaq have extensive bare sand seabed in 0 – 10 m
  - A number of protected species identified
- Area 3:
  - Rocky substratum often extends to -20m
  - Large expanses of bare sand/rocks/boulders
  - Extensive algal forests in 0 – 15m
  - No *Posidonia* in NE half; extensive in SE half

Area 1 - photos



Area 3 - photos



Marine Geology & Geomorphology

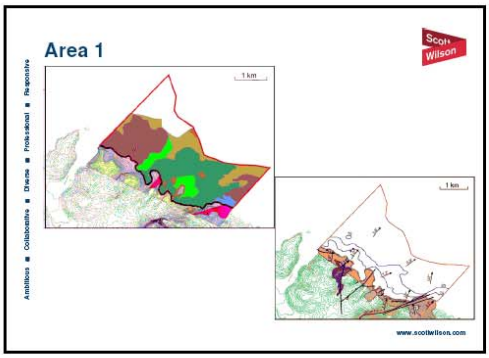
- Objective – to characterise the geology & geomorphology of the seabed
- Desk Study of existing geological data & maps
- Review of data from previous surveys (non-geological)

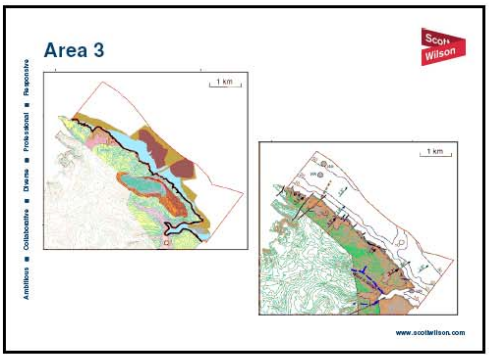
Geology - Progress

- Desk Study completed
- Review of existing data completed
- First draft report completed
- Awaiting conclusion of benthic video survey to analyse footage for any additional data that may be obtained

Geology - findings

- Area 1:
  - Seabed generally gently sloping
  - Maximum depth = 44m
  - Contours generally parallel except where affected by faults
  - A small 10m deep shoal located c. 1.2km off Ghallis Point
- Area 3:
  - Contours generally steeper than Area 1
  - Maximum depth = 62m
  - No outstanding features apart from a shallow shoal. A sewage pipeline and two wrecks


Area 1
1 km
1 km
Ambitious ■ Collaborative ■ Diverse ■ Professional ■ Responsive
www.scottwilson.com


Area 3
1 km
1 km
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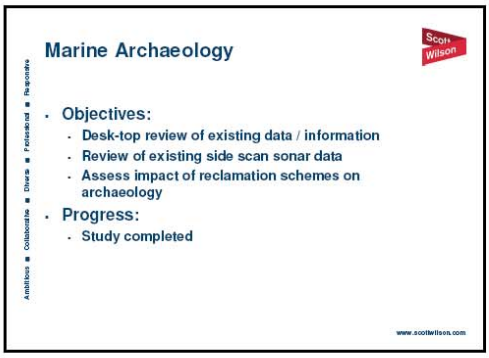
Marine Archaeology
Objectives:
Desk-top review of existing data / information
Review of existing side scan sonar data
Assess impact of reclamation schemes on archaeology
Progress:
Study completed
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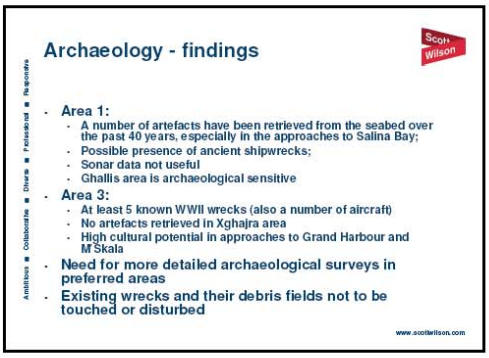
Archaeology - findings
Area 1:
A number of artefacts have been retrieved from the seabed over the past 40 years, especially in the approaches to Salina Bay;
Possible presence of ancient shipwrecks;
Sonar data not useful
Ghallis area is archaeological sensitive
Area 3:
At least 5 known WWII wrecks (also a number of aircraft)
No artefacts retrieved in Xghajra area
High cultural potential in approaches to Grand Harbour and M'Skala
Need for more detailed archaeological surveys in preferred areas
Existing wrecks and their debris fields not to be touched or disturbed
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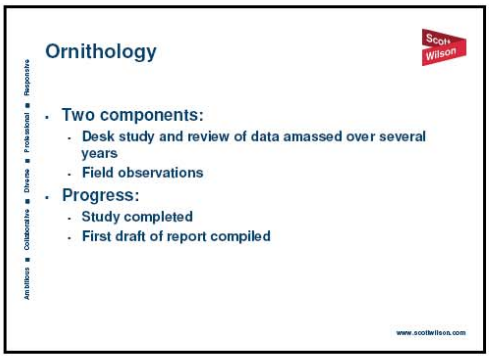
Ornithology
Two components:
Desk study and review of data amassed over several years
Field observations
Progress:
Study completed
First draft of report compiled
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Ornithology - findings
Area 1:
Close to Salina Bay & saltpans (attracts waders)
Much less disturbed than Area 3
Shearwaters fly over the area to breeding grounds in north (fly at 1-3 km from shore)
A number of breeding birds recorded onshore
Area 3:
Offshore area much more frequented by gulls and terns
Shearwaters fly at 2-5km from shore
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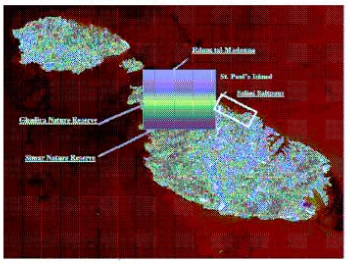
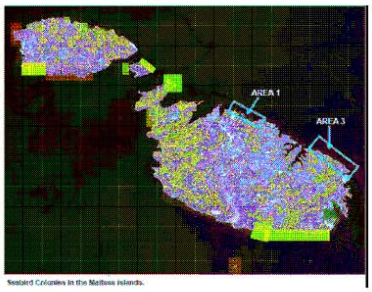
Features of ornithological importance

- Low-lying coast is ideal as resting and feeding grounds for herons, egrets, waders, gulls
- Islets in Area 1 are important for waders and waterfowl
- Northern part of Area 1 (due to proximity to Salina) is important
- Tas-Safra also important due to its seasonal flooding
- Coastal scrub vegetation important for feeding and breeding



Areas of Ornithological importance close to Area 1



Seabird Colonies in the Maltese islands.

Fisheries

- Study involves a desk study of historic fisheries data in the two areas
- Method involves:
  - Review of local publications
  - Review of historic fisheries data
  - Review of relevant local legislation
- Progress:
  - Review of publications & legislation on going
  - Awaiting fisheries data

Technical Report 2 – Contents

1. Waste Stream
2. Possible Reclamation Options
3. Reclamation Options
4. Reclamation Uses
5. Infrastructure
6. Economics
7. Environment
8. Overall Assessment
9. Recommendations

1. Waste Stream

- Report in preparation
- Other examples of use of waste for reclamation – Jersey, Hong Kong
- Material properties –
  - excavated material typically 30% < 75 micron – must be bunded for nearshore disposal
  - demolition waste 5-10% of total
- Volumes, sources
  - Current production - 2 million tonnes/yr (1 million m3)
  - Future scenarios

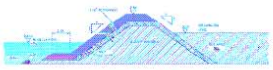
2. Possible Reclamation Options

- Dump site – current practice, but at lower level of dumping
- Submerged island - ruled out, no benefit
- Emerged island/land extension

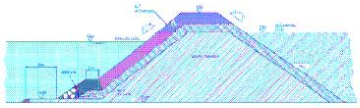
3. Reclamation Options

- Report in preparation
- Sites, areas, volumes
- Edge protection costs MTL 5 000-50 000 / linear m, depending on depth
- Placement costs MTL 3-5/ m^3
- Construction methods – rubble mound bunds, circular steel caissons as used at Freeport, concrete caissons
- Phasing
- Eliminate options in greater depths than -20m chart datum, based on technical difficulties and cost

5m water depth

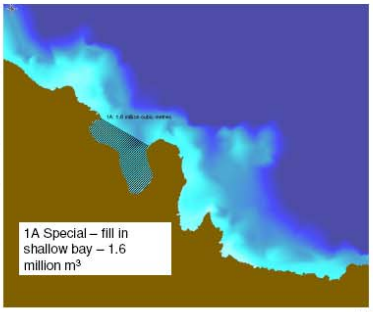


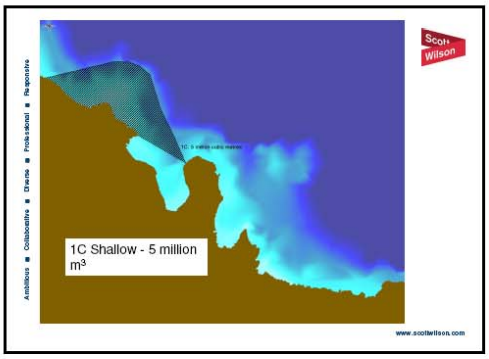
15m water depth

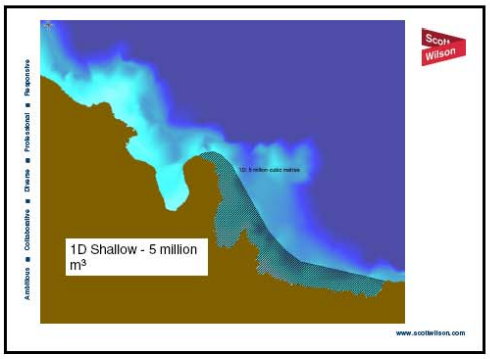


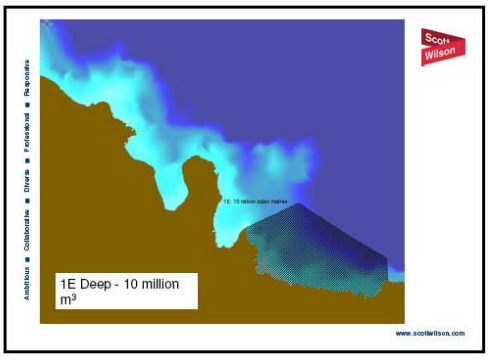
Selecting Possible Reclamation Shapes

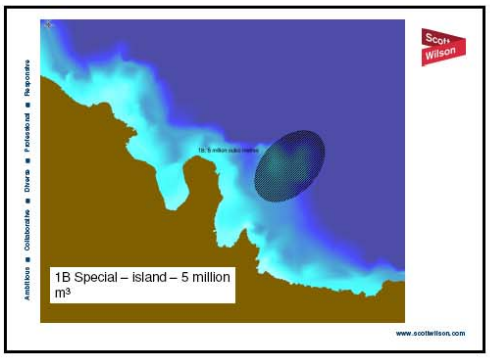
- Options need to cater for at least 5 years production – 5 million m^3
- Max requirement is 20 years – 20 million m^3
- Therefore select 5,10 and 20 million m^3 as basic building blocks for comparison purposes, many options can then be made from these building blocks
- Various types identified:
- Greatest area created for volume - avoid deep water, keep to shallow water
- Greatest storage capacity for unit area - extend to deep water
- Specials – shapes which are 'obvious' or unique because of bathymetry
- Total 11 shapes at present

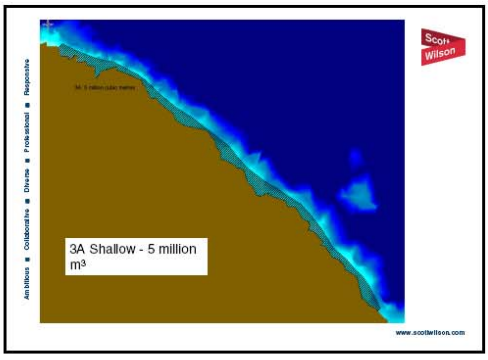


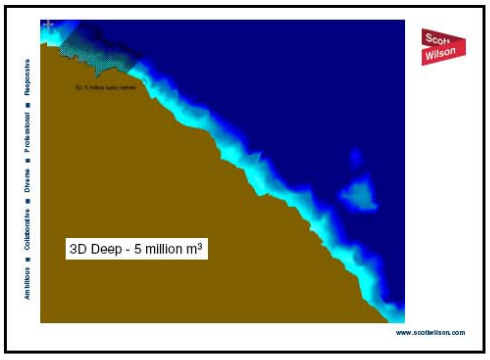

1C Shallow - 5 million m³

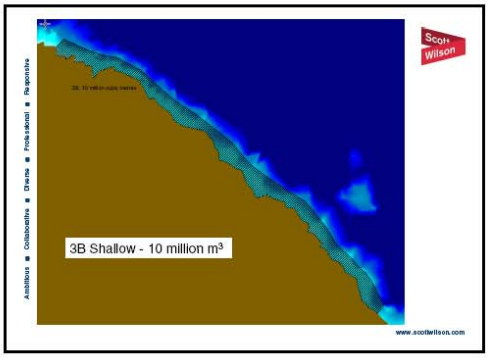

1D Shallow - 5 million m³

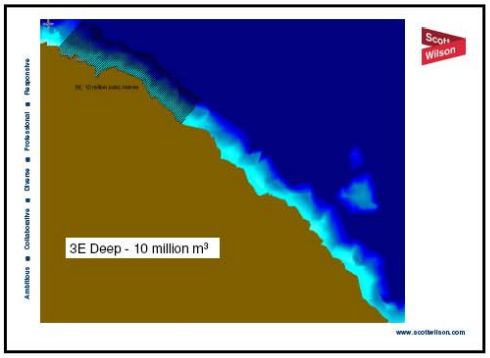

1E Deep - 10 million m³

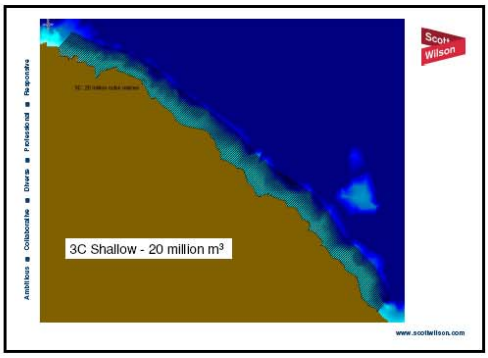

1B Special – island – 5 million m³

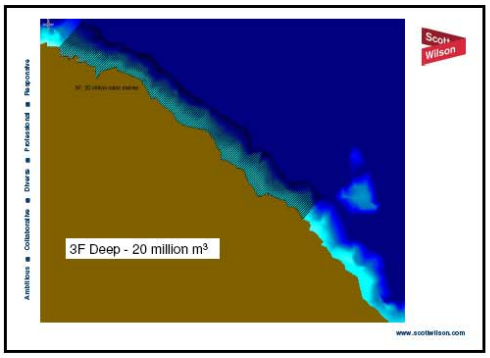

3A Shallow - 5 million m³

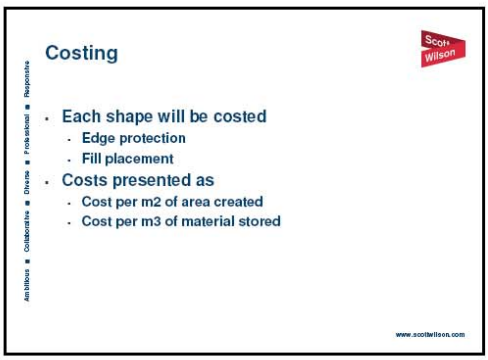

3D Deep - 5 million m³

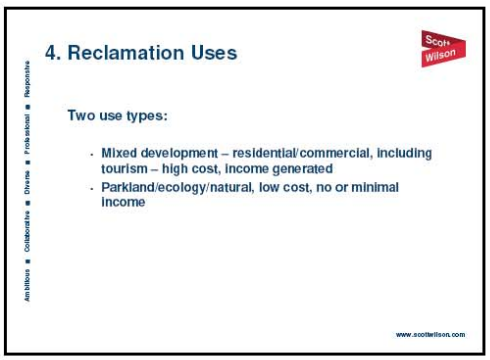

3B Shallow - 10 million m³

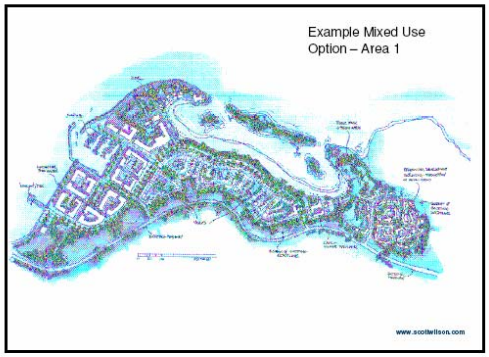

3E Deep - 10 million m³


3C Shallow - 20 million m³


3F Deep - 20 million m³


Costing
Each shape will be costed
Edge protection
Fill placement
Costs presented as
Cost per m2 of area created
Cost per m3 of material stored


4. Reclamation Uses
Two use types:
Mixed development – residential/commercial, including tourism – high cost, income generated
Parkland/ecology/natural, low cost, no or minimal income


Example Mixed Use
Option – Area 1
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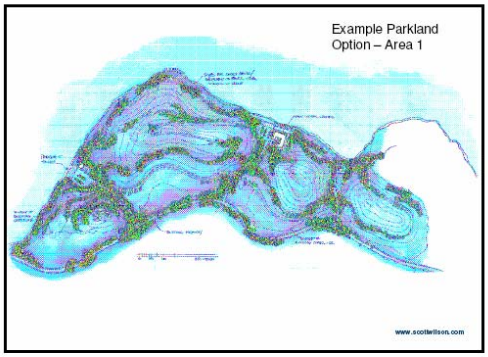
Example Parkland
Option – Area 1
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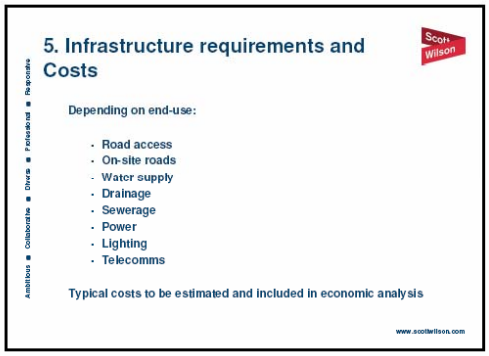
5. Infrastructure requirements and Costs
Depending on end-use:
Road access
On-site roads
Water supply
Drainage
Sewerage
Power
Lighting
Telecomms
Typical costs to be estimated and included in economic analysis
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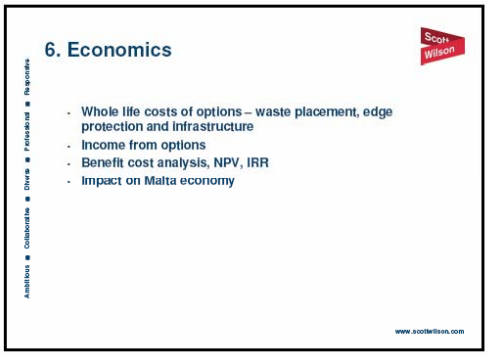
6. Economics
Whole life costs of options – waste placement, edge protection and infrastructure
Income from options
Benefit cost analysis, NPV, IRR
Impact on Malta economy
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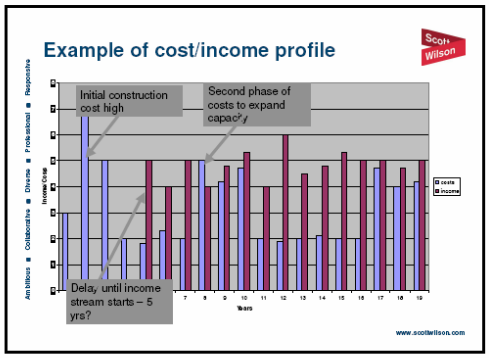
Example of cost/income profile
Initial construction cost high
Second phase of costs to expand capacity
Delay until income stream starts – 5 yrs?
Years
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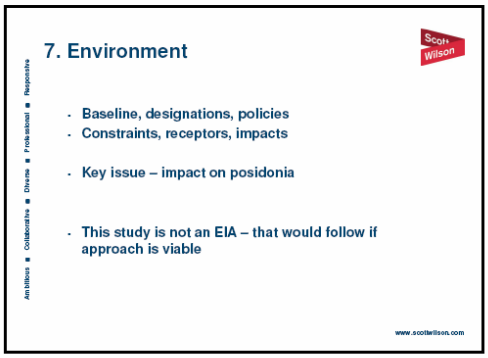
7. Environment
Baseline, designations, policies
Constraints, receptors, impacts
Key issue – impact on posidonia
This study is not an EIA – that would follow if approach is viable
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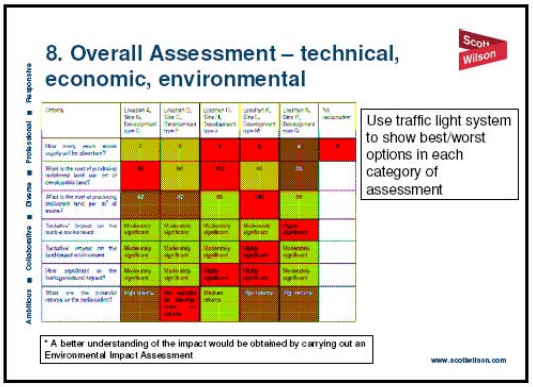
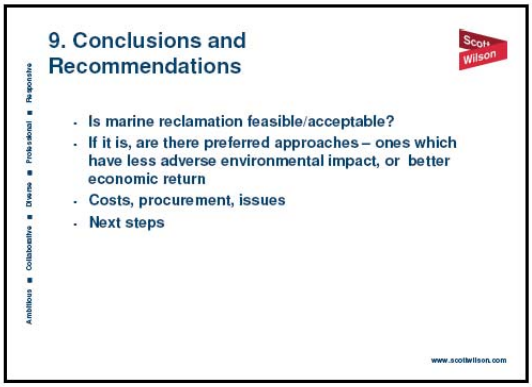
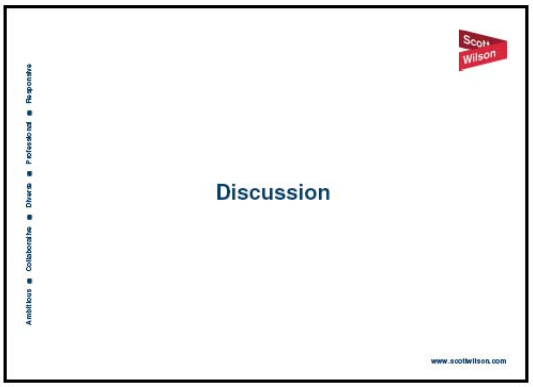






Stakeholder Workshop Minutes

Workshop Details

Date: 6 September 2007
Time: 10:30 – 13:30
Panel: Adrian Mallia (AM) (Adi Associates); David Dales (DD) (Scott Wilson); Vincent Gauci (VG) (MEPA); Russell Foxwell (RF) (Scott Wilson)

Agenda

1. Opening and objectives of the project;
2. What is land reclamation? Discussion of benefits and disbenefits;
3. Progress and investigation to date;
4. Discussions and feedback; and

5. Closing summary.

Minutes

1. VG opened the workshop with an introductory speech where he summarised the history of the development of the project to date and the purpose of the current studies and the workshop.
2. Following the introduction, DD and AM presented the progress the consultants have made to date. DD described the technical and economic aspects of the feasibility study; AM described the environmental baseline studies that are being carried out and presented the results gathered thus far.
3. VG opened the floor for comments and questions from participants.

Discussion

4. **Vincent Magri (VM), WasteServ Ltd**: Could land reclamation continue around the disused spoil ground off Xghajra given that that area is now shallow?
5. **DD**: In an area that has been used as a dump there are a number of uncertainties from an engineering point of view in that the detail of the material dumped there is not known. It would be technically difficult to construct edge protection structures on top of a dumpsite. Moreover, the shoal does not provide enough shallow area.
6. **AM**: There is the added risk from potential ordnance dumped at the site during the war.
7. **VM**: Whilst the studies are going on for land reclamation, we should dump waste at the existing shoal.
8. **DD**: Unconfined dumping is different to land reclamation.
9. **Louis Vella (LV), MEPA**: The studies carried out thus far are interesting, however, they should be linked to impacts on the hinterland resulting from this project in social, economic and environmental terms.
10. **AM**: This is only a feasibility study. If a site is chosen for a specific reclamation scheme, detailed impact assessments would be carried out which would include social, economic and environmental impacts on the hinterland.
11. **Anthony Valvo (AV), Mayor of Xghajra**: Have studies on water currents been carried out during adverse weather conditions, such as during a storm? The south-easterly wind strongly impacts the coast at Xghajra. Studies should be carried out during winter too.
12. **DD**: Currently, we are looking at feasibility in principle, not a detailed assessment at each site. We are also limited by budget and time available for this aspect of the project, however, if you have any data, we would be very interested in seeing it.
13. **AV**: Xghajra Local Council have commissioned two studies on the geological coastline of Xghajra and water quality. Whether or not this project comes to fruition all depends on the economic feasibility. We can use material that is already at Maghtab.
14. **DD**: We are investigating the volume of waste available, you are right that cost is an important aspect of the project. Land reclamation is very expensive in particular when considering that Malta's waters are very deep.
15. **Kevin Morris (KM), Adi Associates**: An issue to consider is whether the private sector would be interested in taking on such a project given the massive

initial cost. The private sector would need to maximise on its return in as short a time as possible. Is there the potential for a public-private partnership?
16. **George Camilleri (GC), Din l-Art Helwa**: What criteria govern the acceptability of this project other than economic?
17. **AM**: The project assesses the feasibility of land reclamation in terms of technical, environmental and economic issues; the overall level of acceptability is a combination of all three elements. For example, a proposed option may be technically feasible but environmentally unacceptable.
18. **GC**: Environmentally it is obviously unacceptable so a decision will still be based on economics.
19. **AM**: I disagree that such a statement can be made. It is not the purpose of this project to make a decision on whether or not to proceed with land reclamation. The study will put forward information to allow others to make an informed decision. Impact assessment must be carried out (as will happen in the EIA) and the impacts identified will be presented to the decision-maker so that they can take an informed decision about the project. Although the feasibility study does not include impact assessment, it does include an environmental appraisal that can influence the final proposal on which an EIA will be carried out.
20. **DD**: There is also an element of comparison of strategies, this project cannot be seen in isolation. The issue of what to do with waste must still be tackled. The different options of waste disposal each have their own environmental impacts and these should be compared.
21. **GC**: It is not the aim of this feasibility study to look into other strategies.
22. **DD**: Yes, however, we can recommend in our report that it should be considered alongside other strategies.
23. **RF**: Other studies are, in fact, being carried out, currently there is a twinning project with Austria underway..
24. **Hans-Joerg Zerz (HJZ), Twinning expert**: Yes, I am here on the twinning project where we are investigating how to reduce the generation of waste and increasing separation of waste, including recycling opportunities. The outcome of our project could be an alternative to this.
25. **Joe Sciortino (JS), Consultant**: To come back to Kevin's comment about private sector involvement, based on my experience, the private sector needs as large an area as possible and it may need to import waste or encourage the generation of more waste to fill it as quickly as possible, which goes against the principle of what you (Hans) are looking at. The private sector would want to finish the land reclamation within five years.
26. **HJZ**: Yes, there is a large uncertainty factor when predicting waste generation.
27. **J. Attard (JA), Malta Chamber of Commerce**: Is the CarlBro report a public document? Was public consultation carried out when four of the proposed areas were excluded? Did MEPA decide on its own to exclude these four areas?
28. **VG**: The document is public and available on the MEPA website, I can send it to you. Short listing of the six sites was carried out by MEPA and approved by Government.
29. **Andrew Vella (AnV), Ministry for Rural Affairs and Environment**: Does the cost of land reclamation quoted in your presentation include transport and cost of additional structures? As a generator of waste, how much will it cost me to dump at the reclamation site?
30. **DD**: The cost does not include transport. Policy on landfill cost in Malta is relevant when considering the cost of dumping, it depends on perspective,

whether private or public. The existing charges for landfill are very low compared for example, to the UK.
31. **AnV**: Have you estimated the cost? As a waste producer, I would obviously choose the cheapest option to dispose of my waste.
32. **DD**: Yes, indeed to attract the private sector to this venture, there must be a policy that drives the material towards land reclamation.
33. **VM**: We must consider that there is a demand for waste disposal, we do not have the space available on land, the overall aim must be to deposit waste. We should retain what land we have available, for disposal of that waste which cannot be disposed of at sea.
34. **DD**: Yes, however we still do not know the value. By changing policy, one can change the value. Increasing cost of disposal to landfill will drive disposal towards land reclamation.
35. **AnV**: It will soon become the only option available so whoever runs the land reclamation project can put any price on accepting the waste. Is it part of your brief to propose an end use for the reclaimed land?
36. **DD**: The project is considering generic end uses. To date, the project team has not been provided with information that there is an urgent need for any specific end-use.
37. **AM**: We are looking at a spectrum with one end being high value development (e.g. like SmartCity) and the other end being low-income generation (e.g. parkland).
38. **AnV**: Have you carried out land valuation?
39. **AM**: The economic assessment has not started yet.
40. **RF**: Does anyone here have any ideas for end use?
41. **VM**: Waste management facilities since these are 'undesirable neighbours'.
42. **VG**: Siting obnoxious industry on reclaimed land is not the preferred option since it is better to raise the standards of waste management facilities, rather than attempting to relocate them far away.
43. **KM**: Given that the Freeport has run out of space, maybe we can look into port uses.
44. **VG**: There is also a demand for yacht marinas.
45. **JA**: Land reclamation is expensive so it is probable that a high-value end use would be the only way to make it financially feasible.
46. **JS**: We need to remember that land reclamation in Malta will be close to the coast or an extension of the coast because of the large water depths around Malta, so if heavy industry were to be located on reclaimed land, it will still not be a great distance from centres of population.
47. **DD**: The site could be used for ports, where strategically there could be a positive economic impact even if a loss is made financially in the development of the project.
48. **JS**: Why not extend the Freeport and reclaim land at the Freeport site?
49. **JA**: What was the motivation behind the shortlisting of Areas 1 and 3? Were they chosen because of their links with other issues (such as proximity to Smart City or Maghtab) rather than holistically?
50. **VG**: CarlBro developed criteria which they used to identify potential sites. This study is not linked to Maghtab; there is no plan to dismantle Maghtab.
51. **DD**: The other sites were excluded because they were not considered suitable, for example, one site was proposed at Sliema, and there were other sites that included tourist areas which were not considered appropriate for land

reclamation. Another thing that must be considered is that Malta does not have a great extent of coastline that can be used for land reclamation purposes.
52. **GC**: We have created holes in the land to create this waste, can we simply re-fill these holes?
53. **VG**: We are, however, the spaces will soon be exhausted.
54. **VM**: We should note that we are using calcium carbonate for reclamation, which is a valuable mineral, and should not be referred to as waste. As recently as 1995, WasteServ had to purchase Globigerina to use as capping material for landfill sites. It is MEPA's change in policy to restrict development to specific zones which has forced large amounts of excavation resulting in high volumes of waste being produced. A substantial amount of the excavations carried out are to produce underground car parks or basements (and not from quarrying per se), so the excavated material has to go elsewhere. In Gozo, WasteServ's contractor has already stopped activities because there is nowhere to put the excavated overburden material.
55. **VG**: Spent quarries have been identified which could receive excavation waste, however they are privately owned and the owners are reluctant to refill.
56. **HJZ**: The issue of the fluctuating value of excavation waste is one of the fundamental uncertainties of a land reclamation project. A developer would neeed to make the investment in a containment structure but would have no certainty that the fill material will be freely available to complete the scheme after the initial investment.
57. **VG**: Yes, and these uncertainties remain.
58. **VM**: Could we consider having a number of shallower islands to store this material which might be re-used later?
59. **DD**: In theory, yes, that is one way to test the project, by having a stop-gap, interim approach, it would also cost the least.
60. **JS**: However, the material must still be stabilised because it's 30% dust.
61. **DD**: Yes, it would still be bunded.
62. **JA**: Does MEPA have a timeframe for a decision to be taken on whether or not to go for land reclamation?
63. **VG**: The deadline for the feasibility study is the end of 2007.
64. **Yvette Rizzo (YR), MEPA**: In the presentation you mentioned the option of a submerged island. Could this be used to create an artificial reef?
65. **DD**: Excavated Globigerina material has a high percentage of fines so it needs to be bunded before being deposited in the sea. An effective reef structure would require voids to create new habitat, however this type of voided structure cannot be created with fine Globigerina material.
66. **AM**: In order to produce an artificial reef with the material, it must be set in concrete to produce a suitable module. If large quantities of Globigerina are used to create concrete modules to form the reef, similarly large quantities of other materials would be required in order to create the blocks, so this is unlikely to be a realistic option.
67. **DD**: This option is high cost with relatively low use of material. We will address this issue in the report.
68. **YR**: When estimating costs, did you cost the environmental impacts, i.e. environmental economics?
69. **AM:** Environmental impact would be assessed for a specific proposed reclamation scheme rather than at general feasibility stage.
70. **AnV**: Will excavation material need to be treated for it to be used as reclamation fill?

71. **DD:** We do not have details of this at this point. The degree of processing depends on the end-use. We are looking at options which accommodate the widest range of inert waste possible.

Conclusion

72. VG concluded the workshop by summarising the points that were discussed.

3 Annex B: Marina Demand Analysis

Demand Assessment Methodology

3.1 The Study Terms of Reference require high level assessment of the potential demand for marina facilities in Malta. Such information would inform the feasibility of the reclamation, and in particular the land use analysis and financial feasibility.

3.2 This study draws on marina studies undertaken for Malta Maritime Authority[1], updated where necessary and appropriate. Since the latter study was undertaken in 2005, little has changed in respect of marina provision; a site for the reprovision of the Royal Malta Yacht Club has identified. It will provide temporary berthing facilities.

3.3 The MMA study was conducted and involved both local and international research and a selection of trade interviews as follows:

- An analysis of selected published research into the growth of yacht and boat ownership in the Mediterranean, such as the British Marine Federation's 2004 European Overview;
- An analysis of published research into the growth of marinas across the Mediterranean and the range of facilities provided, updating the research in the original Yachting Subject Study;
- Meetings with a number of local players within the yachting industry including all marina operators, several yacht handling agents and other companies in related services. The purpose of the meetings was to establish their specific views on issues such as existing marinas, potential demand for more berthing space, the potential competition, service issues, pricing and Malta's potential in the yachting industry in general;
- The consultants also met with Mr Chris Schembri (MMA Berthmaster) to familiarise themselves with the existing facilities provided by MMA and to obtain the views of the MMA's yachting directorate on the yachting industry in Malta;
- MMA also provided its statistics on the usage of existing berths and moorings, yacht ownership, small boat ownership and the waiting list; and
- The Armed Forces of Malta made available their statistics for visiting yachts since 2001.

Yachting in Europe and the Mediterranean

3.4 Europeans own 6 million boats[2] and an estimated 32 million people participate in boating. Boating and yachting is universally recognised as a sub-set of recreational watersports that

[1] Xemxija Marina Studies: A Strategic Assessment prepared by Deloitte and Touche, Adi Associates Environmental Consultants Ltd, and Architectural Project for Malta Maritime Authority, 2005.
[2] Source: British Marine Federation, European Overview 2004. Not including boats under 2.5 metres but including jetskis

provide social and cultural opportunities for the general population at large. It is universally acknowledged that leisure boating and yachting has increased substantially in popularity during the last 30 years. This is due to a number of factors, but can be principally attributed to a general increase in the affluence of the general public, the availability of a wider range of recreational craft and their increased affordability at an entry-level, and an increase in marine facilities as a result of waterfront developments and regeneration schemes.

3.5 The Mediterranean, with its maritime tradition, suitable climate, and attractive cruising grounds is a hive of yachting activities, and the yachting industry is a well-established and important contributor to many Mediterranean economies. Some of the best known cruising grounds in the world are located in the Mediterranean, with the South of France, Italian Riviera, Sardinia and the Greek Islands all being important yachting destinations of international renown. In addition, there are significant levels of yachting activity in Spain, Croatia and Turkey, where it is typically complementary to coastal tourism activity.

3.6 Boat ownership in Europe is highest in the Scandinavia countries, where per capita boat ownership is nearly 10 times higher than in other countries with 10 boats per 100 members of the population. In Europe as a whole boat ownership is 1.3 boats per 100 members of the adult population. In the Mediterranean, boat ownership is typically slightly lower at 1.1 boats per 100 members of the population as GDP per capita is lower in Southern Europe than in Northern Europe. However, our immediate neighbour to the north – Italy – has relatively high levels of boat ownership at 1.7 per 100 members of the population, and this could present an opportunity for visiting yachtsmen.

Table 3-1: Boat ownership per capita

Country/Region	No of Boats (2004)	Boats per Head (2004)
France	938,000	2.0 per 100
Spain	160,000	0.5 per 100
Italy	**800,000**	**1.7 per 100**
Greece	68,200	0.8 per 100
Turkey	56,400	0.1 per 100
Croatia	52,800	1.5 per 100
Mediterranean Sub-Total	**2,075,400**	**1.1 per 100**
Total Europe (30 countries)	**5,990,000**	**1.3 per 100**

Source: BMF 2004

3.7 Out of the 6 million boats in Europe, 88% are small craft (i.e. within the 2.5 to 7.5 metre range or 8 to 25 feet). These are, therefore, unlikely to require a marina berth or travel on international journeys to Malta.

3.8 This leaves approximately 233,000 boats in the Mediterranean bordering countries that might travel overseas to a destination such as Malta and therefore generate demand for a marina berth producing the corresponding economic benefits associated with visiting yachtsmen.

3.9 Out of the 233,000 boats 'of marina size' around 90% fall within the 7.5 to 12 metre range (25 to 40 feet), with just 10% being represented by larger boats (12 to 24 metres / 40 to 80 feet) and a much smaller potential being represented by super yachts.

Table 3-2: Boat length by country

Country/Region	Length (m)				
	2.5 to 7.5	**7.5 to 12**	**12 to 24**	**Over 24**	**Total**
France	811,000	101,000	11,100	132	923,232
	88%	11%	1%	0%	100%
Spain	183,000	14,700	2,730	42	200,472
	91%	7%	1%	0%	100%
Italy	778,000	64,000	12,000	11	854,011
	91%	7%	1%	0%	100%
Malta	4,560	369	69	1	4,999
	91%	7%	1%	0%	100%
Cyprus	9,120	737	139	1	9,997
	91%	7%	1%	0%	100%
Greece	101,000	7,990	1,500	13	110,503
	91%	7%	1%	0%	100%
Turkey	91,300	7,350	1,360	12	100,022
	91%	7%	1%	0%	100%
Croatia	86,700	6,980	1,300	11	94,991
	91%	7%	1%	0%	100%
Mediterranean Sub-Total	2,064,680	203,126	30,198	223	2,298,227
	90%	9%	1%	0%	100%
Total Europe (30 countries)	5,180,000	608,000	77,700	412	5,866,112
	88%	10%	1%	0%	100%

Source: BMF 2004
Note: Boat Park represents resident boats in the country in question

3.10 Of the total 6 million boat population in Europe, typically some 81% of boats are motor boats, with just under 16% being sailing yachts (and motor yachts). Sailing boats are generally more popular in Northern European countries than in the Mediterranean. For example, in Italy the proportion of sailing boats is just 13% of the total compared to 20% in France and 19% in Europe as a whole.

Table 3-3: Boat type by region

	Sail	**Motor**	**Jetskis**	**Total**
Mediterranean	373,350	1,922,750	63,500	2,359,600
	16%	81%	3%	100%
Total Europe (30 countries)	1,120,000	4,750,000	106,000	5,980,000
	19%	79%	2%	100%

Source: BMF 2004

3.11 Countries that have a strong yacht production base are reporting significant growth rates in the marine industry.

3.12 Italy is the most important boat builder in Europe in value terms (as it also constructs a number of super yachts), whilst France is the biggest boat builder in volume terms. The world's biggest sailing brand is Beneteau / Jeanneau (France) followed by Bavaria (Germany). Major Italian motorboat brands include Ferretti, Cranchi, Azimut / Gobbi, Sessa, Fiart, Riva and Rio. For models over 12 metres major UK brands come into play such as Sunseeker, Princess, and Fairline & Sealine. The UK's British Marine Federation reports that, in 2004, the overall UK marine industry grew by 8.5% and that over 53% of recreational craft produced were exported to other EU countries.

3.13 In 2003, sailboat production across Europe amounted to 11,040 yachts whilst motorboat production was marginally higher, at 12,328 boats, suggesting that the growth rate is almost 50:50 between motor and sail amongst craft that would use a marina.

3.14 The total number of boats produced in 2003 was 23,368 which, relative to a European boat population of 686,000 for craft of this size (7.5 to 24 metres), suggests an annual growth rate of between 3 and 4% per annum. This is generally higher than population growth rates in many countries and suggests that the overall incidence of boat ownership in Europe is increasing over the medium term.

Table 3-4: European Boat production in 2003

	Length		
	7.5 to 12m	**12 to 24m**	**Total**
Sailboats	8,240	2,800	11,040
	75%	25%	100%
Inboard / stern drive motor boats	5,870	2,790	8,660
	68%	32%	100%
Other motor boats (including outboards)	3,630	38	3,668
	99%	1%	100%
Total Europe (30 countries)	17,740	5,628	23,368
	76%	24%	100%

Source: BMF 2004

3.15 The super yacht industry (defined as ocean going yachts, typically of over 24 or 30 metres) is also experiencing rapid growth, as the fleet doubles in size each decade, as yachts are kept in service for longer due to better repair and refit services. Super yachts are luxury items, and the owners are very image conscious. International industry estimates indicate that there are over 2,400 super yachts at present and several hundred under construction.

3.16 The simple process in yachting that has always created growth is the desire to have a bigger yacht.

Marinas in the Mediterranean

3.17 As one would expect, demand for boat ownership feeds the supply of marina berths. Over the period 1994 - 2004 years it would appear that there has been a 67% growth in the number of yacht marinas across the Mediterranean, from 176,000 berths to 250,000 berths, a 42% increase.

3.18 The biggest growth in yacht marina berths has been in Italy, Sicily and Tunisia, which are all neighbouring cruising grounds to Malta. The number of yacht marinas in Italy and Sicily has more than doubled in a decade:

Table 3-5: Increase in marinas and berths 1994 - 2004

Country/Region	No of Marinas	No of Berths	No of Marinas	No of Berths	Growth
	1994	1994	2004	2004	
France (Med. Coast)	79	63,024	94	67,248	7%
Corsica	12	5,719	19	6,404	12%
Gibraltar	3	475	3	519	9%
Spain (Med. Coast)	76	36,556	98	47,616	30%
Balearics	26	11,830	36	13,830	17%
Italian Mainland (incl. Sardinia)	73	30,915	209	74,432	141%
Sicily	5	1,865	20	4,740	154%
Malta	2	1,056	5	1,800	70%
Tunisia	3	1,480	9	2,594	75%
Cyprus	2	577	3	637	10%
Greece	10	5,600	15	6,070	8%
Turkey	17	4,998	24	8,065	61%
Yugoslavia / Croatia	45	12,015	53	16,240	35%
Total	353	176,110	588	250,195	42%
Increase			67%	42%	
Average Marina Size		499		426	

Source: IMRAY Mediterranean Almanac / Deloitte

3.19 In addition, it would appear that yacht marinas are under construction in most of the above major countries.

3.20 The increase in yacht marinas in Sicily is of particular interest, as this is both an opportunity and a threat to Malta in terms of attracting visiting yachtsmen. Since the Yachting Subject Study was conducted, 15 new marinas providing 2,875 berths, an average of 192 berths per marina, have come on-stream.

Yachting & EU Economic Growth

3.21 As with other forms of recreation expenditure and discretionary spending, yachting trends are tied indirectly to trends in disposable income and economic growth.

3.22 The 42% increase in the number of Mediterranean berths described above is mirrored almost identically by the increase in underlying personal income as the GDP per capita of the EU15 member states rose by 44% in the same period.

3.23 Within the EU, it is generally expected that a similar level of economic growth will continue, and that this in turn will continue to fuel future demand for yacht ownership.

Yachting in Malta

3.24 As in other Mediterranean countries, boating and yachting in Malta has long been a popular recreational sport. Given Malta's urban environment and hot climate, the sea is generally seen as the only open space to 'get away from it all' and both yachting and swimming are important social amenities.

3.25 As Maltese standards of living have risen over the last 20 years, boat ownership has risen accordingly. Entry levels into the yachting world now start at little more than the price of a family car for a second hand day cruiser, taking boating out of the domain of the wealthy few and into the mass market, at least for smaller craft.

Boat Ownership in Malta

Yachts

3.26 Pleasure yachts which are over 6 metres (20 feet) and wish to conduct international voyages must be registered under the Malta Flag with the MMA's Merchant Shipping Directorate under the Merchant Shipping Act.

3.27 In view of the popularity of Sicily as a nearby cruising ground for local yachtsmen, we believe that the majority of yachts that would seek a marina berth would be registered under the Malta flag rather than on the small crafts registry.

3.28 There are approximately 2,100 yachts registered under the Malta flag and this has been growing each year.

Table 3-6: Pleasure yacht ownership in Malta 2000 - 2007

	2000	2001	2002	2003	2004	2005	2006	2007
Pleasure Yachts	1,370	1,381	1,475	1,567	1,787	1,849	1,966	2,112
% Increase		*1%*	*7%*	*6%*	*14%*	*3%*	*6%*	*7%*
Increase in Number		*11*	*94*	*92*	*220*	*62*	*117*	*146*

Source: MMA

3.29 It is noted that the above headline growth trend in the above data for 2004 is distorted by the one-off 5% VAT offer for yachts prior to EU membership in 2004 which enticed foreign-owned yachts to pay Maltese VAT at 5% and benefit from EU-VAT registration post 1 May 2004. Ignoring this one-off result the average number of yachts registered on the Malta registry each year would appear to be around 90.

3.30 However, a large number of these yachts would necessarily be based in Malta or belong to Maltese beneficial owners, as the Malta flag is an important international maritime flag. From our review of a sample of the underlying data, it would appear that between one third and one quarter of the pleasure yachts on the Maltese registry are ultimately not owned by Maltese residents and therefore unlikely to be based here.

3.31 In previous years, when MMA used to operate all the marinas in Malta, it used to report data that allowed the ratio of permanent berth-holders in Malta to Malta-flagged yachts to be computed. In 2001, the last year for which this data was published, just over 50% of the yachts on the Malta flag were permanent berth holders in Malta. If this trend were to be broadly maintained and extrapolated to the typical increase in the number of yachts registered each year, this would suggest that out of the 90 yachts registered each year under the Malta flag, some 45 to 50 would be seeking a permanent berth in Malta.

3.32 According to the yacht agents interviewed in 2005,[3] the estimated number of brand new yachts imported into Malta each year is significantly less than the increase shown on the registry of 90 each year. Agents indicated that the number of new yachts and powerboats (of marina size) sold in Malta each year is around 25 to 40, and that in addition there are some second-hand yachts which are also imported and registered under the Malta flag.

3.33 The BMF European Overview for 2004 reported that in 2003 Malta imported €4.0 million (Lm1.7m) of new yachts. This would appear to confirm the yacht agent's estimates that a relatively small number of new yachts each year are imported into Malta.

Small Craft

3.34 The small craft registry is maintained by the Yachting Directorate in respect of vessels of over 3.6 metres (c. 12 feet) and under 24 metres (c. 80 feet) in length employed solely in navigation within the waters of Malta. This is known as the 'S' register (as boats have a registration number beginning with S). Of the 5,400 listed craft it would appear that a number have been scrapped, retired, sunk or stolen and the core number of active seacraft is around 4,800.

3.35 The number of boats on the small crafts registry has been growing at a much faster rate than the number of pleasure yachts under the Malta flag, and has been growing at around 400 boats per annum over the last 5 years. This is equivalent to annual growth of around 8% on present levels. However, this will include many small craft unsuitable for marinas.

[3] Xemxija Marina Studies: A Strategic Assessment prepared by Deloitte and Touche, Adi Associates Environmental Consultants Ltd, and Architectural Project for Malta Maritime Authority, 2005

3.36 The MMA does not keep details of the size of the craft in question, but only of the engine size in question.

Table 3-7: Malta - Small Craft Registry 2005

Engine capacity	Distribution	Number	Marina User %	Possible Demand for Berths
Under 10 horsepower	1%	52		
10 to 25 horsepower	14%	674		
25 to 50 horsepower	21%	1,000		
50 to 75 horsepower	13%	639	10%	64
75 to 150 horsepower	37%	1,777	15%	267
Over 150 horsepower	14%	654	25%	164
	100%	4,796		494
% of total small craft				10%

Source: MMA data + Deloitte estimates

3.37 It is therefore difficult to precisely estimate how many of the boats on the small craft register would seek a marina berth, as clearly very small craft (say, those under 7 metres or 23 feet) would probably prefer to remain on a mooring or be taken up on land after use, given the proportionate cost of a marina berth. Demand is likely to be very price sensitive.

3.38 If one were to expect 25% of seacraft with an engine size of 150 horsepower and over to be of a size that would ideally seek a marina berth, together with 15% of the seacraft in the next category (75 to 150 horsepower) and 10% in the next category, then the above table suggests that there are up to 500 small craft that might seek a marina berth. These will primarily be larger speedboats / day-cruisers and small sailing yachts (as no international voyages are permitted if you are on this register) and their owners are likely to be very price-sensitive.

3.39 In 2001, out of 1,381 pleasure yachts registered under the Malta flag, 726 or 52% were permanent berth-holders. The total number of permanent berth holders irrespective of registry or flag status was 946, suggesting that over and above the pleasure yachts under the Malta flag were about 220 small craft or foreign-registered yachts in Malta's marinas at the time.

3.40 The demand for marina berths by small craft will also depend on other factors such as pricing, location, and the availability of alternative moorings and hardstanding.

3.41 The demand for a marina berth for small craft may increase during the winter months. Insurance regulations state that craft not in a marina are typically not insured beyond September and must go up on the hard. Given the lack of hardstanding in Malta one would expect a number of small craft to temporarily seek a marina berth during the winter period.

3.42 The small craft register is growing by around 400 small craft each year, but only a very small number of these (say 10%, or 40 boats per annum) may create future growth demand for a marina berth, but this will be very price-sensitive.

Penetration of Yacht Ownership in Malta

3.43 Based on the above analysis, the total number of yachts registered in Malta is approximately 6,800, being 1,800 pleasure yachts under the Malta flag and just under 5,000 seacraft on the small craft registry (foreign owned yachts under the Malta flag and Maltese owned yachts under foreign flags are assumed to have an equal and opposite effect, cancelling each other out for the purpose of this analysis, as no data is available). A total fleet of some 6,800 boats relative to an adult population of 317,925[4] implies a boat-owning ratio of 2.1 per 100 members of the population.

3.44 Malta's ratio of 2.1 boats per 100 members of the population represents a high penetration of yacht ownership relative to other European countries. It is higher than Italy's ratio (1.7 per 100), notwithstanding a much higher GDP per capita, and higher than the average of 1.1 for the Mediterranean region and 1.3 for Europe as a whole. Cyprus, which has only a slightly higher level of GDP per capita than Malta, is reported by the BMF to have a ratio of 1.0 per 100 members of the population.

3.45 This may suggest that Malta's overall level of yachting penetration may start to reach saturation levels, and that past rates of growth in boat ownership may not continue at the same pace in the future.

Moorings in Malta

3.46 A large number of small craft use moorings, many of which are unofficial and currently unregulated.

3.47 Data is naturally only available for those moorings which are official and managed or at least authorised by MMA. There are 3,400 such moorings and nearly 500 applications for moorings, MMA confirms that there has been little change since 2005. The highest concentration of these moorings is at Xemxija (465) and Marsascala (510).

Table 3-8: Managed Moorings by location (2005)

Location	Registered	Pending
Bugibba	331	62
St Georges Bay Birzebbugia	311	51
Msida	73	114
St Julians	213	48
Il-Maghluq, Mxlokk	18	56
Mgarr, Gozo	190	82
Temporary Moorings		
Ta Xbiex / Pieta / Lazaretto	141	

[4] Source: NSO, Census 2005

Dockyard / Kalkara Creek	67	
Gzira / Sliema Creek	172	
Marsascala	510	
Xemxija & Veccia	465	52
Qawra	62	
St Pauls Bay	22	
Mistra	8	
Mellieha Bay	41	
M'xlokk Harbour + Rdum il Bies	161	
St Georges Bay St Julians	114	
Bbugia	35	
Other	32	
Wied iz Zurrieq / Ghar Lapsi	81	
Marsalforn	65	
Xlendi	30	
Grand Total	3,442	465

Source: MMA

3.48 The above list of 3,400 official moorings contrasts with the 5,000 registered small craft and suggests that a large number of small craft must be on unregistered moorings.

Hardstanding in Malta

3.49 Despite the above growth in marina berths, hardstanding facilities have not increased accordingly and are in fact expected to diminish substantially as a result of the Manoel Island redevelopment. This has led to the creation of several inland facilities and is generally thought to be limiting Malta's efforts to attract the international winter maintenance niche market. The original Yachting Subject Study had recommended that up to 500 hardstanding spaces be provided (taking into account the displacement of some of the existing facilities on Manoel Island). Deloitte noted that all members of the yachting trade confirmed that the provision of additional hardstanding facilities (i.e. a slipway and travel hoist, not a sophisticated repair facility for larger yachts) is a critical requirement for the continued development of this industry. The provision of suitable hardstanding could be one of the unique selling points of a new marina development.

Marinas in Malta

3.50 The number of available marina berths in Malta has grown by over 75% since 1994, resulting in an increase of over 800 berths to 1,860 berths, equivalent to approximately 73 berths per annum. Although this is broadly in line with the growth predicted in the Yachting Subject Study, this represents a slower rate of growth than the rapid increase experienced over the period 1989 to 1993, when the number of berths rose from 364 berths to 1,056 berths, representing an increase of 173 berths per annum. However, this increase took place at a time of high domestic economic growth and full capacity at all existing marinas and therefore included a strong element of pent-up demand.

3.51 Malta now has three private marinas and two municipal marinas.

Table 3-9: Marina berths in the Maltese Islands 1994 - 2007

Marina berth location	1994	2005	2007	Notes
Lazaretto Quay / Manoel Island Marina	57	400	400	Privatised 2002
MMA Msida / Ta Xbiex Yachting Centres	774	800	837	
MMA Sliema Creek	60	60	25	Summer-only. No facilities
Vittoriosa / Grand Harbour Marina	8	230	250	Opened in 2002. Only 50% full
Portomaso Marina	na	140	110	Opened in 1999
Excelsior Hotel		40	40	
Subtotal Malta	899	1,630	1,662	
Mgarr Marina, Gozo	157	230	210	Destination Port for local yachtsmen
Maximum Berth Capacity	1,056	1,860	1,872	
% Increase		*76%*	*0.01*	
Increase in Number		*804*	*12*	

Source: MMA Annual Report, marina management:

3.52 In addition to the marinas described in Table 3-9, VISET occasionally uses its Grand Harbour quays for visiting super yachts, typically those on a short stop to replenish and refuel.

Other Planned Berthing Facilities or Marinas

3.53 The Dock One project, which is adjacent to Grand Harbour Marina, is also expected to include a small marina in the area. This might increase the overall number of berths in Dockyard Creek very marginally in 3 to 5 years time.

3.54 The Environmental Impact Assessment associated with an application for urban development and a marina in a disused quarry in Hondoq ir- Rummien, Qala, Gozo indicates that the provision of 100 - 150 berths, depending on the configuration.

3.55 When the MIDI development on Manoel Island goes ahead, the Manoel Island yacht marina is likely to be expanded slightly through the addition of another pontoon, to satisfy demands for berthing space from residents within the MIDI development.

3.56 It is likely that, as a result of agreement with MIDI and Government, the Royal Malta Yacht Club will seek to provide berthing for visitor at Marsamxett Harbour, to support specific club activities such as the Middle Sea Race. This would probably be a seasonal facility.

3.57 It is understood that MMA is studying the construction of a 200+ berth marina at Xemxija, and possibly another at Marsaskala harbour.[5]

3.58 Excluding the MMA proposals and the Qala Marina, other planned facilities are on a small scale and ancillary to landside developments. Between them it is thought that they would contribute to only a marginal increase in berths and would therefore not have a significant impact on the potential need for marina developments elsewhere in Malta. However, when added to the vacant berths still available at Grand Harbour Marina, it becomes evident that for the next few years, supply of marina berths will probably broadly equate to demand.

3.59 The increase in the supply of berths to date has resulted in an overall position that is very similar to the headline estimated in the Yachting Subject Study, which envisaged a requirement for 2,000 berths by 2007.

3.60 However, the difference is that local demand has remained a key component part of the overall composition of demand, and that not all the marinas have full occupancy, so that some aspects of demand has risen at a slower pace than originally envisaged. Certain market segments, such as yacht chartering (insufficient demand, two failed attempts by specialist companies), visiting yachtsmen (high fuel prices to visit, alternative nearby cruising grounds, cheaper destinations) and unattended wintering yachts (insufficient hardstanding, possibly insufficient promotion) have failed to materialise to the extent envisaged, whilst other market segments, such as super yachts (very attractive bunkering prices) and local demand (steady annual growth), have exceeded original estimates.

Waiting List for Berths

3.61 Notwithstanding the increase in marina berths in Malta over the last decade, there is a waiting list for MMA berths that has almost doubled in just under 10 years from around 240 berths to 430 as follows:

Table 3-10: MMA marina berth waiting list 1995 - 2007

	1995	**2000**	**2004**	**2007**
Number of Yachts & Small Craft	240	383	400	430

3.62 The existence of such a waiting list when Grand Harbour Marina is not fully committed, strongly suggests that the waiting list is not motivated by a requirement to find a berth but by price, given the substantial price differential that currently exists between private marinas and MMA marinas. A secondary factor that could be motivating yachtsmen to be on the waiting list is location, as it is generally expected that the next marina will be at Xemxija, and another possibly at Qala, both of which enjoy proximity to the main cruising ground and in respect of Xemxija in particular, easy road access.

3.63 The pricing factor, while currently a decisive factor in the waiting list, is likely to decrease in importance when MMA privatises its marinas, resulting in berth rentals that reflect market rates, and increasing the import of marina location and facilities.

[5] See Northwest and South Malta Local Plans

3.64 However, given that the MMA waiting list may at least be indicative of a general desire to move from a private marina or a mooring to a well-designed marina with attractive facilities, the MMA waiting list (as at 2007) indicates that:

- The split between motor boats and sailing yachts is 55% / 45%;
- Over 70% of applicants reside in the northern half of Malta. 10% have an overseas address;
- 76% of yachts on the waiting list have a length of between 8 and 12 metres (26 to 40 feet); and
- The overall split of yachts on the waiting list is as follows:

Table 3-11: Waiting list boats (2007)

Length	Applicants	%	Comment
<8m	41	10%	Probably on a mooring
8 to 9m	188	44%	Probably on a mooring
10 to 12m	133	31%	Probably in a private marina
13 to 15m	46	11%	Probably in a private marina
16 to 20m	16	4%	Probably in a private marina
21 to 25m	2	<1%	Probably in a private marina
over 25m	4	<1%	Probably in a private marina
Total	430	100%	

Source: MMA data and Deloitte estimates

3.65 Unlike the situation prior to the existence of private marinas in Malta (i.e. when there was no spare berthing capacity), there is absolutely no guarantee that the MMA waiting list is not simply a 'wish list' by yachtsmen to move to a cheaper berth. Deloitte and Adi Associates noted that both MMA officials and members of the yachting trade were extremely sceptical of the claim that there could be this sort of number of yachts which need to be in a marina and are currently not in a marina.[6]

3.66 It would, therefore, be incorrect to say that there exists immediate pent-up demand on a national level for 400 additional marina berths on the basis of the waiting list.

3.67 It would also be reasonable to suggest that some of the smaller craft could be better served by a managed mooring and would be unlikely to pay the commercial going rate for a privately operated marina berth.

Potential Demand for a Marina as Part of Land Reclamation

3.68 As with any potential development, it is up to the developer to assess whether to follow a 'demand-led' or a 'supply-led' approach and this will depend in part on their attitude to risk and the overall financial and business model. One could well argue that, to a large extent,

[6] Xemxija Marina Studies: A Strategic Assessment prepared by Deloitte and Touche, Adi Associates Environmental Consultants Ltd, and Architectural Project for Malta Maritime Authority, 2005

whenever marina facilities have been provided in Malta, over a short to medium-term period they have been fully taken up. The purpose of the following analysis is, therefore, not to dictate to a future developer which segments of potential demand should be targeted, but to better inform MEPA about the potential opportunities that a developer may identify.

3.69 As in the previous Subject Study, the potential demand for marina berths associated with a land reclamation project may be analysed in terms of the following key market segments:

3.70 **International Summer visitors** - it was previously felt that whilst Malta had obvious potential appeal to visitors, particularly from Italy, the unavailability of berths at the time was constraining this market segment. In 1994, the number of visiting yachts was around 1,500. However, it would appear that despite the provision of new facilities since then the number of visiting yachts has not in fact increased but has declined quite substantially (higher fuel costs, competition from a re-emerging Croatia, no longer outside EU and, therefore, duty free etc), although recently it has partially recovered and currently stands at around 2000 visits a year, well up on the 1,245 visiting yacts in 2005.

Table 3-12: Foreign visiting yachts to all marinas

Vessel type	1994	2002	2003	2004	2005
Yachts & Motor Boats	1,463	600	561	1,033	925
Super-yachts	60	208	258	299	320
Total	1,523	808	819	1,332	1,245

Source: Valletta Port Control; *2005 data up to mid-October*

3.71 Deloitte / Adi Associates' 2005 analysis of the above statistics[7] suggests that:

- 60% of visiting yachts are motor boats, 40% are sailing yachts but the mix of sailing yachts is increasing;
- 45% of all visiting yachts range between 11 and 16 metres (approximately 36 to 53 feet);
- Super-yachts[8] have become an important component of the overall total and now represent some 26% of all visitors (see below); and
- Approximately 50% of the above visitors use the MMA Msida marina, just over 10% use the MMA Gozo facility, with the remainder being split between the Grand Harbour Marina, Manoel Island Marina and Portomaso on a 2:1:1 ratio (200 / 100 / 100 yachts).

3.72 Based on the above, and given that there is capacity for visitors within Malta's marinas overall, and in view of the opportunities for marinas at Xemxija, Marsaskala, and Hondoq ir-Rumien, it seems unlikely that additional berths at another new marina *per se* would significantly alter or increase the number of visiting yachts.

[7] Xemxija Marina Studies: A Strategic Assessment prepared by Deloitte and Touche, Adi Associates Environmental Consultants Ltd, and Architectural Project for Malta Maritime Authority, 2005
[8] Defined for the purposes of these statistics as 26m or 78 feet and over

3.73 **Local Visitors** – the Destination Port Concept was outlined in the Gozo and Comino Local Plan and essentially refers to seasonal, short-term summer time managed moorings or berths located in areas where overnight yachting would be complimentary to existing tourism and recreational infrastructure. The general concept is that by offering planned moorings or summer berths the damage to the seabed would be minimised and the necessary supporting infrastructure (garbage, WCs etc) would be provided.

3.74 Traditionally Maltese yachtsmen tend to gravitate towards Gozo and Comino in the summer months as overnight destinations. The MMA Mgarr Marina is permanently full during summer weekends with local visiting yachtsmen. Mellieha is another popular bay with local yachtsmen for overnight stays.

3.75 There is no reason why part of a facility associated with the land reclamation could not be developed s a destination port.

3.76 **Super yachts** – Malta's location between the Greek and the French cruising grounds together with its excellent repair facilities has given Malta a very good inroad into this market segment, which is specifically targeted by the Grand Harbour Marina and Manoel Island Marina. Over the last 10 years the level of demand has grown by a factor of 5 and increased from 60 visiting super-yachts per annum to over 300 as seen in the previous table.

3.77 For Malta, they also present an opportunity for repair work (Malta Superyachts, a division of Malta Drydocks, actively targets this work together with Bezzina Shipyards) and for replenishing and bunkering en route to their ultimate destination. However, Malta is not presently considered to be an ultimate destination for super-yacht owners but a rest and relaxation break for crew.

3.78 Superyachts are currently accommodated in Malta by Grand Harbour Marina (which has 12 max berths and is located close to Malta Drydocks) and by Manoel Island Marina (which has 18 maxi berths and is located close to the Ta' Xbiex Yachting Hub) or, exceptionally, by VISET Malta plc (Cruise terminal operators). It seems likely that once MIDI plc develops Manoel Island and leisure facilities at Lazarretto then Manoel Island Marina will target super-yachts even more than at present.

3.79 Yachting agents have pointed out that super yachts have a high economic impact per visit, with a spend of Lm12K to Lm15K per visit, mostly on berthing fees, fuel, provisions and crew entertainment. This is, therefore, a segment that should continue to be targeted, although marinas in the Ta' Xbiex Yachting Centre will have an edge over other marinas due to their location.

3.80 It will be up to the eventual developer and operator of any new marina facility to determine whether or not to provide facilities for super-yachts, which would depend on the target audience of any landside development.

3.81 **Yacht charters** – this was another market segment that Malta was not supporting a decade ago but was growing strongly in the Mediterranean as a whole, in line with consumer demand for activity-based holidays. At the time of the Yachting Subject Study, it

was felt that, with the right facilities, Malta could support a small fleet of charter yachts. Since then two companies have tried to break into this market but it has not reached any critical mass and this is unlikely to change through the construction of additional marina facilities.

3.82 **Unattended wintering yachts & Liveaboards** – Malta remains potentially well-placed to attract this market (with good air links to Europe and good yacht repair skills), but is still suffering from a lack of hardstanding to target this market internationally. Until there is a national policy to provide sufficient hardstanding for local needs, it seems unlikely that a new marina will be able to target unattended wintering yachts as a significant market segment. Albeit both Grand Harbour Marina and Manoel Island Marina appear to have made some inroads into the unattended wintering yacht segment, although no statistics are available.

3.83 As experienced with other private marinas, the liveaboard market segment is much more likely to choose a location closer to the Ta' Xbiex Yachting Centre and the marina with the lowest possible fees.

3.84 **Permanent berths (Maltese & Foreigners)** – The number of occupied year-round berths in Malta & Gozo increased from approximately 996 in 1995[9] to 1,685 in 2005, representing an increase of 689 berths over the 10 year period, which averages out at demand for permanent berths growing at a national level at the rate of approximately 70 berths per annum.

3.85 This is broadly consistent with the above analysis of increases in the demand for berths from a number of sources from the yacht-supply side, as follows:

- The number of new yachts sold in Malta was estimated in 2005 by yachting agents at 25 to 40 per annum;
- The annual increase in the number of pleasure yachts registered under the Malta flag is around 90 per annum (representing new yachts, second hand yachts imported into Malta, and yachts not based here but registered under the Malta flag);
- However based on previous historic trends of yacht registration to requests for permanent berths in Malta, some 45 to 50 yachts out of the total of 90 would create demand for permanent berths in Malta. This is inclusive of the brand new yachts mentioned above; and
- A small number of yachts on the small craft registry are large enough to also add to demand for a marina berth, depending on pricing and location.

3.86 Assuming that any new private marina would charge commercial rates, and further assuming that the MMA marinas are privatised and berthing fees at them increase to levels commensurate with the private marinas, some displacement to marinas closer to the popular cruising grounds in the north of the country might be expected.

[9] The number of all-weather berths available n Malta at the time, which had 100% occupancy, compared to the estimated number of permanently occupied berths in Malta at present.

3.87 The success of the Portomaso development demonstrates that a holistically planned 'marina village' consisting of berths, food & beverage outlets, some commercial outlets, and residential development is very successful, to the extent where in addition to local residents it attracts expatriates to purchase second homes in the 'marina village' and also base their yachts there. This aspect, together with the important potential financial contribution that landside development can make to the viability of a marina is a key consideration. Portomaso has successfully sold a large proportion of its residential apartments to foreigners, and in turn the majority of its berths are taken up by such foreign purchasers. Manoel Island is likely to see similar synergy. If a similar proposition is developed on a land reclamation, there is a similar potential for a significant amount of permanent berths to be taken up by foreign purchasers of adjacent property, increasing demand for permanent berths beyond the 25 to 40 new yachts sold every year in Malta.

3.88 On the basis of the above, it is estimated that demand for permanent berths is likely to follow two scenarios, depending on whether the marina is part of an overall residential development or not:

- Scenario One: A new marina on land reclamation is a stand-alone facility with no adjacent residential component, demand for permanent berths will be driven almost solely by new yacht ownership in Malta. Once all other marinas in Malta reach full capacity, all new yacht registrations would generate demand for such a facility. This would range between the 25 to 40 yachts per annum as analysed above, but would only arise once the marinas in the pipeline are at or close to full occupancy.
- Scenario Two: A new marina on land reclamation is developed with an adjacent residential component or 'marina village', demand is likely to be higher, and would partially be a function of the size of the actual residential development and its marketing strategy. Although this cannot be properly estimated at this point in time, the experience at Portomaso suggests that it could be possible to target a take-up of some 50 to 100 permanent berths linked to property ownership by non-residents.

Demand Summary

3.89 Based on the above analysis and assumptions, demand for marina facilities developed as part of the land reclamation project once the marinas in the pipeline are at or close to capacity will in part depend on whether the development is part of an overall marina village or a stand-alone facility, and may be summarised as follows:

- National demand for permanent berths by local yachtsmen is likely to slow down but will still be in the region of 40 to 50 berths per annum across all marinas;
- The marina will win its 'fair share' of international visitors and should therefore cater for around 15 to 25 berths for larger yachts for this market segment.

- If the marina is part of a Portomaso-style development, then demand will be much stronger and could justify a larger marina. However, the extent of this demand will then depend on the overall development, its business plan, and marketing strategy.

3.90 It is assumed that by the time a marina development on reclaimed land opens in say 15 years, the existing capacity at Grand Harbour Marina and any capacity brought on stream at the Excelsior and other marina expansion / development will be fully taken up. If this is not the case the developer will inevitably factor this into his analysis during the development period.

4 Annex C: Discussion of Relevant Legislation

Introduction

4.1 There are three types of applicable legal sources, which must be looked into when examining the feasibility of carrying out land reclamation operations. These are International law, the European Union's *Acquis Communautaire* and national legislation. Some of these legal sources constitute an international obligation, which is binding whether or not they have been transformed into national legislation[10]. Other legal obligations emanate solely from national legislation[11]. The distinction between sources of national legislation and the *acquis communautaire* is only tackled when there is a discrepancy between the *acquis* source and Maltese legislation transposing it. When the position is harmonized only reference to the Maltese legislation is made. In those few cases[12], where transposition has not yet taken place,[13] Malta's legal obligations must be traced directly from the *acquis communautaire.*

4.2 This list of sources provides the following main obligations:

- Legal obligations determining Malta's jurisdiction and territorial status over the areas where the reclamation is proposed.
- Legal obligations and laws relating to safety and non-hindrance of maritime traffic.
- Legal obligations to inform and consult other States and International Organizations and laws providing access to information to the general public and public participation in decision- making.
- Legal obligations and laws regulating impact assessment at the strategic and later on at the implementation level of the project.
- Legal remedies providing access to justice in environmental matters and environmental liability.
- A monitoring and enforcement regime to ensure that the laws applicable would be respected.

The Substantive Legal Obligations

4.3 National legislation is always directed at legal and natural persons who are either of Maltese nationality or who commit a breach of Maltese law when in Maltese territory. Such legal obligations are enforceable by the Maltese courts. EU law is enforceable against the government of the day by the European Court of Justice after a significant period of

[10] This would be the case, for instance, for obligations arising under the Dumping Protocol to the Barcelona Convention, the Biodiversity Convention etc..
[11] Examples would include fisheries laws and occupational health and safety laws
[12] This includes the Environment Liability Directive and the Directive on Access to Justice in Environmental Matters
[13] Both the Directives on Access to Justice and Environmental Liability have not been transposed into Maltese legislation despite the expiration of the transposition deadline for EU Member States.

discussion and exchange of views and legal positions between the Commission and Malta as a member State. International obligations can be enforced only by an International tribunal or the International Court of Justice only if the State accused of breaching International law consents to resort to these institutions. It may be the case that a treaty would set up an adjudicating body whereby Parties in breach of the legal obligations under the said treaty could be brought before it by another State Party without the former having to specifically express consent. Only States can appear before international tribunals or the International Court of Justice.

Legal obligations determining Malta's jurisdiction and territorial status over the areas where the reclamation is proposed

4.4 The land reclamation operations proposed would take place within Maltese internal waters and within Malta's territorial sea. In both instances Malta has sovereignty over these areas so it has authority to carry out these operations in the designated areas according to its domestic laws and policies. Both the internal waters and the territorial sea are together referred to as territorial waters showing the territorial sovereignty Malta has over these waters.

The Applicable Legal Sources.

International Treaties

- 1982 Law of the Sea Convention, Articles 2, 3, 4, 8, 56, 60, 80

Laws of Malta[14]

- Chapter 362 Law of the Sea (Ratification) Act
- Chapter 226 Territorial Sea and Contiguous Zone Act
- Chapter 352 Malta Maritime Authority Act.

The Obligations

4.5 The feasibility of land reclamation is dependant on it taking place in shallow waters. Since the proposed areas earmarked for possible land reclamation are all close to shore, it appears that any land reclamation will probably take place within internal waters or at most within the territorial sea. The applicable legal source, which establishes Malta's legal status over the internal waters and the territorial sea, is the 1982 Law of the Sea Convention (UNCLOS). According to UNCLOS the internal waters are those, "*waters on the landward side of the baseline of the territorial sea.*"[15] Malta's baselines are not defined

[14] http://www2.justice.gov.mt/lom/analytical_index.asp
[15] Vide UNCLOS art 8

in any national legal instrument, but in practice the baselines are those marked in Figure C4-1. The baselines constitute the demarcation line from which the breadth of the territorial sea is measured.[16] the belt of sea adjacent to the internal waters, is defined as Malta's territorial sea. The proposed land reclamation will occurs within internal waters or the territorial sea Malta has sovereignty over these waters[17] and the subjacent seabed and subsoil[18]. International treaty law and Customary International law[19] are consonant in this respect, and the coastal State has a right to carry out reclamation operations in maritime areas subject to its sovereign jurisdiction.

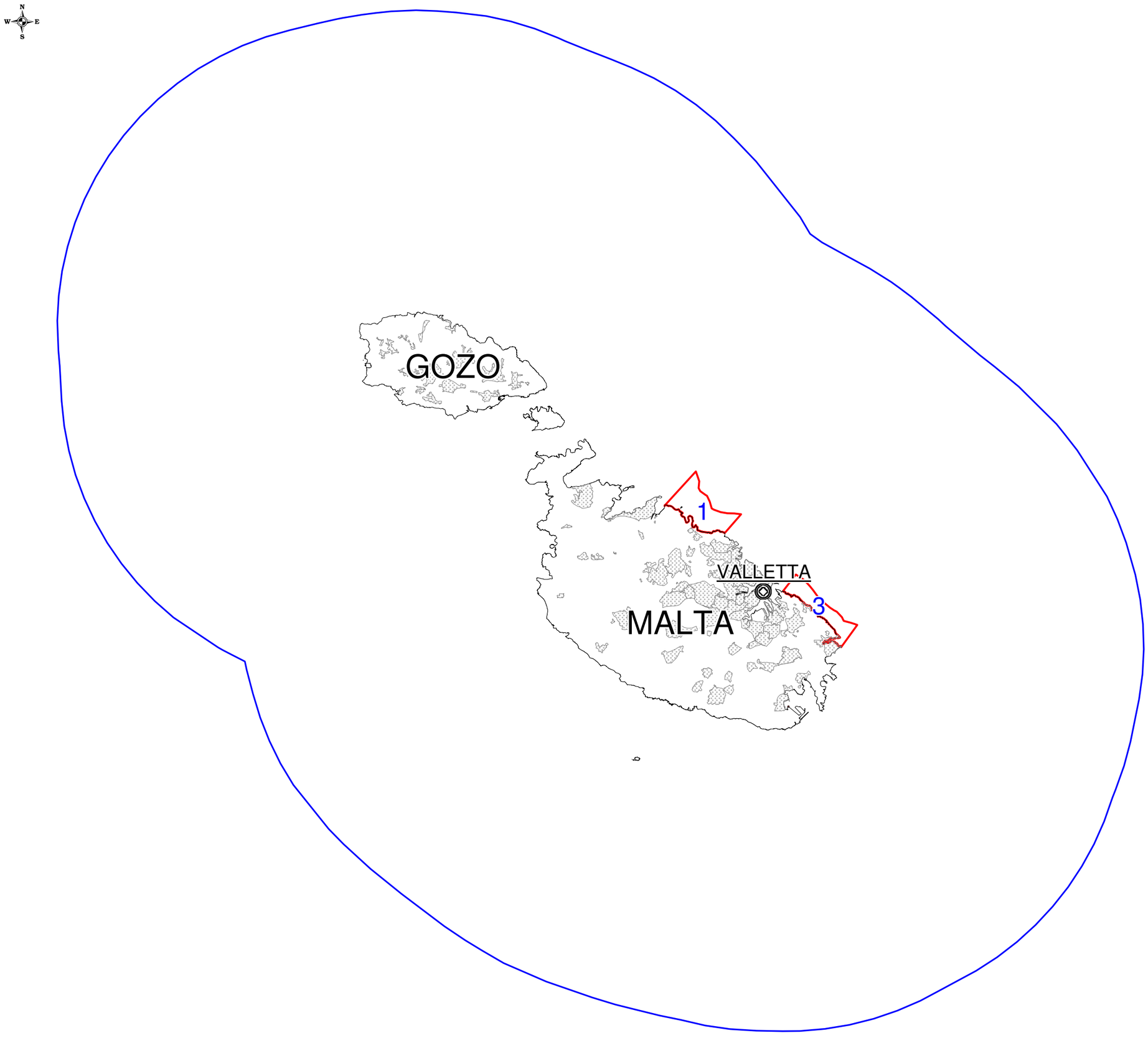
4.6 If the reclamation of land by the coastal State extends or occurs beyond the territorial sea, it is regulated by another provision under UNCLOS, namely article 80[20] under Part VI. The area of the subsoil and the seabed up to 200 miles from the territorial sea is defined under UNCLOS as the continental shelf. All coastal States have a continental shelf, without the need to declare it (as is required with respect to the exclusive economic zone). The coastal State has the exclusive right to construct, authorise or regulate the construction, operation, and use of artificial islands, installations, and structures for economic purposes[21] on its continental shelf. So, under UNCLOS, it would be also permissible for Malta to carry out land reclamation beyond the territorial sea.

4.7 The *acquis communautaire* does not go into issues of State sovereignty or territorial jurisdiction. The Act providing for the ratification of UNCLOS[22] transforms the obligations of the Convention as part of Maltese law. Specific national laws are in place to enable Maltese courts to enforce these provisions. The applicable national legislation under this section is the Territorial Seas and Contiguous Zone Act[23], which is in itself an enabling act and permits the Prime Minister to issue subsidiary legislation. This Act provides a definition of the extent of Malta's territorial waters, which reflects the provisions of UNCLOS[24]. Although they are referred to, there is no definition of internal waters under this Act.[25] The term "*internal waters*", however, is defined under the Malta Maritime Authority Act[26] as including any harbour, port, bay, cove, creek or seashore. Furthermore, the definition of "*territorial waters*" under this same Act, refers to the same definition under the Territorial Waters and Contiguous Zone Act and "*includes any waters enclosed between the base lines therein mentioned and the coast*". This means that under the Malta Maritime Authority Act, the internal waters are included as part of the territorial waters.

[16]Ibid Art 3 and 4
[17]Vide UNCLOS art 2, which says, "*The sovereignty of a coastal State extends beyond its land territory and internal waters… to an adjacent belt of sea described as the territorial sea*".
[18]Ibid Art 2, para 2
[19]Since the 1982 Law of the Sea Convention codifies Customary International law both sources of International law are non conflicting.
[20]Article 80 makes a cross reference to article 60 saying that the coastal State has the same exclusive rights with respect to the continental shelf as it has in the EEZ
[21]This provision actually refers to, "*other economic activities apart from those referred to in article 56*". This article 56 for instance refers to the construction of islands etc for generation of alternative energy.
[22]Chapter 362 Law of the Sea (Ratification) Act
[23]Chapter 226 of the Laws of Malta
[24]Vide ibid section 3 (1) *"Save as hereinafter provided, the territorial waters of Malta shall be all parts of the open sea within twelve nautical miles of the coast of Malta measured from low-water mark on the method of straight baselines joining appropriate points."*
[25]Vide ibid section 5
[26]Chapter 352 of the Laws of Malta

4.8 The enabling powers of the Prime Minister to issue regulations[27] under the Territorial Waters and Contiguous Zone Act does not refer to land reclamation operations, but it does include the power to publish regulations on various other issues that are consequential to it. These will be examined under the separate headings examining various legal obligations below.

[27] Vide ibid section 7



Notes

Search area boundary

12 nm boundary

1 Area number

PROJECT TITLE:

DETAILED INVESTIGATIONS AND FEASIBILITY STUDIES ON LAND RECLAMATION AT TWO INDICATED SEARCH AREAS, MALTA

FIGURE TITLE:

MALTA TERRITORIAL WATERS

SCALE AT A3:

1: 280 000

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FIGURE NUMBER:

FIGURE C4-1

REVISION:

0

Legal obligations and laws relating to safety and non-hindrance of maritime traffic

The Applicable Legal Sources

International treaties:

- 1982 United Nations Convention on the Law of the Sea, Articles 21, 22.

National Legislation

- Chapter 362 Law of the Sea (Ratification) Act
- Chapter 226 Territorial sea and Contiguous Zone Act
- Chapter 352 Malta Maritime Authority Act

The Obligations

4.9 As discussed above, from a jurisdictional point of view, there is no difference whether land reclamation takes place within the internal waters or the territorial sea because Malta has sovereignty over the seabed and the subsoil in both. There is a difference, however, with respect to the obligations Malta has *vis-à-vis* other States, since Malta must guarantee the right of innocent passage to foreign ships in its territorial sea.[28] If land reclamation occurs in the territorial sea area, Malta would probably need to devise sea-lanes and traffic separation schemes. Although Malta is entitled to do so under UNCLOS,[29] it would need to take into account the recommendations of the International Maritime Organization (IMO), any channels customarily used for international navigation, the density of the traffic, and the specific characteristics of particular ships and channels[30]. Some restrictions and changes, therefore, may hinder or make passage more inconvenient and this may create some diplomatic and practical difficulties. Under UNCLOS, Malta must also ensure that any such constructions in its internal or territorial waters do not prejudice the safety of navigation[31].

4.10 The Territorial Waters and Contiguous Zone Act, enables the Prime Minister to issue regulations addressing the passage of ships through territorial waters, including the safety of navigation and regulation of marine traffic, the designation or establishment of sea-lanes and traffic separation schemes.[32] The Maritime Authority, as the competent authority under

[28] On the other hand internal waters are subject to the coastal State's consent and do not include innocent passage.
[29] UNCLOS Art 22
[30] Preliminary consultation with the Malta Maritime Authority of the Study Areas has indicated that the most important factor for them is the extent of reclamation. Activities such as fishfarming and bunkering take place within the study areas. Traffic would definitely be affected especially off the approaches to Valletta Harbour and small craft to Marsascala and Qawra areas. The study areas are very generic therefore a more detailed study to the effect on shipping would have to be done when the exact locations for reclamation are identified. Further consultation with the Authority will be carried out.
[31] Ibid article 21 (a) (b)
[32] Vide Chapter 226 section 7 (1) (a)

the Maritime Authority Act,[33] is the national authority responsible for overall good order and control of navigation within internal and territorial waters[34], the provision of navigational signs and aids and services[35], the control and regulation of any person, ship, vehicle, or goods within any port,[36] and the regulation of the movement of ships within and between ports, their approaches, and the territorial waters.[37]

Legal obligations and laws regulating reclamation operations to prevent and control marine pollution and guarantee the conservation of harvestable and non harvestable marine living resources and their habitat

The Applicable Legal Sources.

International treaties

- 1982 United Nations Convention on the Law of the Sea, Articles 193, 194, 195, 196, 204, 206, 208, 210, 214, 216, 235.
- 1972 London Dumping Convention
- 1978 Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Dumping Protocol.
- 1992 United Nations Convention on Biological Diversity

National Legislation

- Chapter 362 Law of the Sea (Ratification) Act
- Chapter 226 Territorial Waters and Contiguous Zone Act
- Chapter 271 Marine Pollution (Prevention and Control) Act
- Chapter 352 Malta Maritime Authority Act
- Chapter 356 Development Planning Act
- Chapter 425 Fisheries Conservation and Management Act
- Chapter 435 Environment Protection Act
- (LN 337/2001) Waste Management Permits and Control Regulations
- (LN 128/1997) Deposits of Wastes and Rubble Fees Regulations.
- (LN 311/2006) Flora, Fauna and Natural Habitats Protection Regulations.

[33] Chapter 352 of the Laws of Malta
[34] Ibid section 6 (1) (b)
[35] Ibid section 6 (2) (d)
[36] Ibid section 7 (1) (a) (ii)
[37] Ibid 7 (4) (c)

4.11 The legal regime addressing pollution control both on an international or national level targets its sources. One of the main sources of pollution is dumping at sea. In this respect the regulation of pollution applicable to land reclamation operations is centred on the regulation of dumping at sea.

4.12 UNCLOS obligates States to exercise these rights over the subsoil and seabed of their internal waters, territorial sea, or continental shelf in compliance with its Part XII, which refers to the preservation of the marine environment from pollution.[38] Under this part of the Convention, coastal States are obligated to take measures, "*to minimize to the fullest extent,*"[39] pollution from dumping,[40] to prevent, reduce, and control pollution from the use of technologies under their jurisdiction or control,[41] and to protect and preserve rare or fragile ecosystems.[42] In so doing coastal States have a duty not to transfer damage or hazards from one area to another or to transform one type of pollution into another.[43] Article 208 under this Part of UNCLOS specifically refers to the obligations of States to adopt national laws and regulations to prevent, reduce and control pollution from sea bed activities subject to their jurisdiction[44], or from dumping[45], which laws cannot be less stringent than international rules, standards and recommended practices and procedures. This means that Malta should have specific legislation regulating activities and operations on the seabed and subsoil including the dumping of material on it in accordance with the 1996 Protocol to the London Dumping Convention or/and the Dumping Protocol to the Barcelona Convention, which are dealt with below.

"Placement of matter for a purpose" does not constitute dumping at sea.

4.13 The London Dumping Convention and its Protocol together with the Barcelona Convention and its Protocol are the international legal instruments that address dumping at sea. Malta is a party to the London Dumping Convention but not to its Protocol. Malta's international obligations in this respect, therefore, are limited to those found under the London Dumping Convention and the Dumping Protocol to the Barcelona Convention to which it became a Party. Any reference to the Protocol under the London Dumping Convention is not legally binding upon Malta.

4.14 Both instruments exempt the "*placement of matter for a purpose*", if carried out in accordance with these legal agreements, from the definition of dumping at sea. To determine whether land reclamation operations can be classified, as "*placement of matter for a purpose*" requires an analysis of the definition of dumping at sea, to ensure that land reclamation operations do not fall within the scope of "dumping at sea". If this is the case, the operations involved, cannot be termed nor regulated as operations constituting "*dumping at sea.*" Furthermore, the material used for land reclamation must be assessed to see whether it is classified as waste. Once it is classified as waste then it is highly likely that it would not pass the test of placement of matter for a purpose. If it is not classified as

[38] Vide UNCLOS article 193
[39] Vide UNCLOS article 194 (3)
[40] Ibid para 3(a)
[41] Ibid Article 196
[42] Ibid Article 194 (5)
[43] Ibid article 195
[44] Ibid Article 208
[45] Ibid Article 210

waste, the deposit of such matter cannot be regulated as a waste management operation. This does not mean that the placement of such matter would be unregulated and that it would be exempted from the preventive measures to prevent and abate pollution, but simply that it would be not be considered to constitute dumping of waste at sea.

4.15 The Barcelona Convention obliges contracting parties, *"to take all appropriate measures to prevent, abate and to the fullest possible extent eliminate pollution of the Mediterranean Sea Area caused by dumping from ships*."[46] Its Dumping Protocol expands upon this obligation. The Protocol entered into force on 12th February 1978[47] and was later modified by amendments adopted on 10th June 1995[48]. The amended Protocol is known as the Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea. Malta became a party to the amended Protocol, but since the amendments have not achieved the required number of ratifications, the original version of the Protocol is still in force. Given that Malta has ratified these amendments it would still be bound to observe the Protocol in the amended version. The basic obligation of the Protocol[49] declares that the contracting parties shall, "*prevent, abate, and eliminate to the fullest extent possible pollution of the Mediterranean Sea, caused by dumping from ships and aircraft and incineration at sea".* As already mentioned above, the most salient provision of the Protocol, applicable with respect to land reclamation operations, is the article that lays down that dumping does not include, "*the placement of matter for a purpose, other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Protocol"*.

4.16 Land reclamation operations do not constitute dumping, if three conditions subsist.

- Placement of matter is for a purpose, other than mere disposal;
- The matter placed is not prohibited under Annex I[50] of the Protocol; and
- Measures are taken to prevent, abate and eliminate pollution resulting from such placement.

4.17 This position is identical to that adopted by the Protocol to the London Dumping Convention, which lays down, "placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Protocol"[51]. The International Maritime Organization's policy guidelines on the meaning of

[46] Vide Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, as revised in Barcelona, Spain, on 10 June 1995.
[47] http://www.unepmap.org/index.php?module=content2&catid=001001001
[48] By the Conference of Plenipotentiaries on the convention for the Protection of the Mediterranean Sea against Pollution and its Protocols held in Barcelona on 9th. and 10th. June, 1995
[49] Ibid Article 1
[50] The Convention includes a three-part classification of substances with regulations governing the disposal of materials in each category. These are: Annex I – the "black list" (substances that are absolutely prohibited and should be released into the oceans only "in emergencies posing unacceptable risk relating to human health and admitting no other feasible solution"); Annex II – the "grey list" (substances that can be dumped with special permits); and Annex III – materials that are allowed to be dumped under a general permit for all other wastes.
[51] 1996 Protocol to the Convention on the Prevention of Pollution by Dumping of Wastes and other Matter Art 4

"placement," formulated at the Consultative Meeting of the London Dumping Convention Contracting Parties, held in November 2004 list the following elements:[52]

- Placement should not be used as an excuse for disposal at sea of waste materials;
- Placement should not be contrary to the London Dumping Convention;
- Information on placement should be provided by the contracting Parties of the London Dumping Convention to the Secretariat; and
- Materials for placement should be assessed in accordance with relevant waste specific guidelines.

4.18 The National Workshop on the Implementation of the Amended Protocol agreed with these elements for policy guidelines on the subject.

The definition of waste and the matter used for *"placement"*

4.19 If land reclamation operations constitute "*placement for a purpose"* and not dumping, the whole operation would not be subject to a permit for dumping of wastes at sea as required by the Protocol. The position under national legislation, however, also needs to be satisfied; placement operations must overcome two otherlegal hurdles that may require an amendment to current national legislation. The first legal hurdle is whether the matter for placement falls under the definition of waste found under the Waste Management (Permit and Control) Regulations (LN 337/2001), which transpose the Waste Framework Directive.

4.20 The definition of waste under Maltese law runs as follows:

- Environment Protection Act:
  - 'waste' means any thing, substance or object which the holder discards or intends to discard, or is required to keep in order to discard, and includes such other thing, substance[53] or object as the Minister may prescribe.
- LN 337/2001:
  - 'waste' in addition to what is said in the principal Act means any thing, substance, product or object, whether in solid or liquid form, whether hazardous or otherwise, including those listed in Schedule 1 to these regulations, which the holder discards, or intends, or is required to discard, or any other which is deemed to be waste by the competent authority;
- Consolidated Version of definition of waste under Maltese Law:
  - 'waste' means any thing, substance, product or object whether in solid or liquid form, whether hazardous or otherwise, including those listed in Schedule 1[54] to these regulations, which the holder discards or intends to

[52] Vide Expert Report, Conclusions and Recommendations prepared by *Axiak V*. in consultation with MEPA for National Workshop entitled Implementation of the 1998 Amended Protocol on Dumping at Sea, held on17th November 2005.
[53] Under the EPA "substances means any matter, chemical, mixture, compound or product and including fuels, combinations of elements, mixtures or compounds of a chemical reaction, as well as the mixture of substances of different molecular identities"
[54] It needs to be noted that Schedule 1 of the LN 337/2001 is the codification of the Waste Catalogue.

discard, or is required to keep in order to discard, and includes such other thing, substance or object as the Minister may prescribe or which is deemed to be waste by the competent authority[55].

4.21 If the "matter" for placement used in land reclamation operations is classified as waste by the competent authority, then it would be subject to the strict waste management regime under the LN 337/2001, even if it is not termed as dumping at sea. Consequently, although land reclamation has been identified as constituting placement of matter with a purpose, under international law and by the International Maritime Organization, if the matter used is classified as waste, these placement operations leading to land reclamation, would be regulated as a waste management operation under Maltese legislation.

The *"placement of matter"* that is not waste, is subject to a waste management regime

4.22 Another legal hurdle relates to the "matter" that would be used for placement in land reclamation operations. Even if it such matter is not classified as waste under LN 337/2001, it would be made up mainly of rubble, the deposit of which, is classified as a waste management operation under another set of regulations, namely the Deposits of Wastes and Rubble Fees Regulations, 1997, (LN 128/1997). This LN, in fact, would hinder land reclamation operations in many ways. First, because these regulations contradict the Dumping Protocols exemption, that placement of matter does not constitute dumping of waste at sea. Second, the LN requires payment for the dumping of material according to its weight, and third, it only allows the deposit of dredging material at sea at, "a *spoil ground for dredged material having a radius of about 350 meters and centered on Latitude 33°55.1'N and Longitude 14°34.0'E."*[56]

4.23 The LN would, therefore, need to be amended to permit the deposit of matter at sea in an area that is not the one mentioned above, otherwise it would be illegal to conduct any placement of rubble elsewhere[57]. Secondly, if the London Dumping Convention exempts the placement of matter for a purpose, then this LN should provide for this situation accordingly and exempt land reclamation operations from being equated to a waste management operation.

4.24 Unless LN 128/1997 is amended, land reclamation operations would be illegal and classified as deposit of waste at sea not placement of matter with a purpose.

[55] There is, however, a discrepancy between Maltese law and the Waste Framework Directive (WFD). Like the Directive the definition of waste under Maltese law revolves around the meaning of the term 'discard.' The WFD definition of waste requires the substance to be classified as such if it is found in Annex I and if it satisfies the "discard motive/factor". However, unlike the Directive, the Maltese definition of waste does not only require that to be classified as waste, a substance must not only be listed in Appendix I and/or in the Waste Catalogue (found in Schedule I of the LN 337/2001), but it is also subject to the producer's intention to discard it. The way the Maltese definition is formulated implies that a substance may be classified as waste, if the Minister prescribes, or the competent authority (MEPA) declares it to be so, irrespective of whether these two conditions of the directive also subsist. Schedule I of LN 337/2001 is an inclusive list, contrary to Annex I of the Directive, although the Directive itself contains under Q16 a blanket provision, i.e. the possibility to classify as wastes, "Any materials, substances or products which are not contained in the above mentioned categories." Nevertheless, despite this blanket provision, the Directive classifies a substance as waste only if the two conditions mentioned above, concur.

[56] Vide LN 128/1997 Schedule B

[57] Vide Ibid Regulation 3, which lays down, *"No person may deposit any rubble, waste or hazardous waste in any site unless it is a waste deposit site".*

4.25 LN 128/1997 and LN 337/2001 serve to provide controls that would prevent pollution, but the regulation of marine pollution from land reclamation operations *should not* be part of a waste management regime, once land reclamation is not classified as such. Consequently, one should resort to other laws that would regulate marine pollution from land reclamation operations in keeping with the argument that this, "*placement of matter with a purpose,*" does not go against the objectives of the dumping protocols and the London Dumping Convention.

Control of marine pollution from land reclamation operations

4.26 The Marine Pollution Prevention and Control Act[58] should be the main legal source under Maltese law to address marine pollution but despite being amended three times, it has never come into force. The role of the Maritime Authority in this respect is without prejudice to the provisions of the Environment Protection Act, which enables the Minister for the Environment, to issue regulations on marine pollution, with MEPA acting as the competent authority. No regulations on marine pollution control from sea-based sources such as land reclamation have never been issued under the Environment Protection Act.

4.27 Marine pollution may be regulated indirectly under the Habitats Regulations transposing the Habitats Directive, under conditions stipulated in an environment impact assessment or the development permit for depositing/placing matter for a purpose. This round about way of regulating marine pollution exempts, however, a person responsible for polluting the marine environment from a criminal offence for such an action. If the appropriate legislation were in place, the person guilty of polluting the marine environment would still be liable for breaching the Habitats Regulations and the EIA Regulations. Without marine pollution legislation, the precautionary and preventive approach that would be necessary to permit placement of matter that would not go against the objective of the Dumping Protocols cannot be guaranteed.

4.28 Before land reclamation operations can be put into effect, legislation that addresses marine pollution from sea-based sources must be in place and in force.

4.29 Three steps need to be taken to render legal operations utilising rubble and any inert matter used for placement on the seabed. First LN 128/97 needs to be amended to exonerate rubble from being classified as waste if used for land reclamation. This Legal Notice would need to be amended and include as an exception the placement of rubble for the purpose of land reclamation. Second the definition of waste LN 337/2001 needs to exempt rubble used for land reclamation from being classified as waste and third the Marine Pollution Prevention and Control Act needs to be brought into force to ensure that operations at sea do not cause marine pollution.

Land Reclamation and the conservation of marine living resources and their habitat

4.30 Although there is some overlap between the legal instruments, since harvestable and non-harvestable marine living resources are subject to different legal regimes, it is best to tackle them separately.

[58] Chapter 227 of the Laws of Malta

i) The Harvestable Species.

4.31 Land reclamation operations may require conservation measures to be taken to conserve fish and fishing waters. It may also affect existing fishing rights. Harvestable species are subject to the Fisheries Conservation and Management Act[59]. The definition of fish and fishing are very wide under the Act[60] and so may include the taking from the wild of all types of aquatic species. The Act also defines the extent and location of fishing waters, the role of the Director of Fisheries in the conservation of these waters, the species found therein, and the powers of the Director of Fisheries to issue fishing licences. The latter may even be applicable only within certain specific areas.

4.32 This Study has shown that land reclamation is only likely to take place in the internal waters and the territorial sea. Both areas are part of the Fishing Waters of Malta. The Fishing Waters are defined under this Act[61] as: *"(a) the internal waters[62]; (b) the territorial waters declared under article 3(2) of the Territorial Waters and Contiguous Zone Act; and (c) any other marine waters over which sovereign rights for the purpose of exploring and exploiting, conserving and managing the living resources therein are claimed by proclamation, law or convention for the time being in force, or having the force of law, in Malta.*"

4.33 Land reclamation operations, therefore, would need also the approval of the Director of Fisheries, who under the Act[63] has the power to take, "*such measures as he may consider appropriate for the protection of fish stocks from the effects of pollution whether continuous or short term and from the effects, which are harmful or potentially harmful to fish stocks".* He is also responsible for "*the regulation of the conduct of fishing operations"*[64] and *"for the taking of appropriate measures in consultation with such authority as may from time to time be responsible for the environment for the safeguard against extinction of protected species*.[65]" Enforcement[66] under the Act is to be carried out by fisheries protection officers,[67] acting under the direction of the Director.

4.34 Areas earmarked for land reclamation may already be subject to a fishing permit. Under this Act, the Minister may, by means of regulations, require the owners of fishing vessels who desire to fish outside or within the Fishing Waters to apply to the Director for a permit that allows fishing in areas specified in such permits, and as provided for in the regulations which regulations may even provide for permits that grant exclusive rights to fish in areas

[59] Chapter 425 of the Laws of Malta
[60] Vide ibid under Section 2, "fish" means any aquatic animal, whether piscine or not, and includes shellfish, crustaceans, sponges, sea urchins, turtles, aquatic mammals and their young, fry, eggs or spawn and shells and parts thereof and fish meal; "fishing" means: (a) the catching or taking of fish that occur or have grown naturally in the sea;
(b) any other activity which can reasonably be expected to result in the catching or taking of fish or the farming of fish; (c) any operation at sea in support of or in preparation of any activity described in paragraphs (a) and (b);
[61] Ibid section 3
[62] Defined under Act 425 as, *"those seawaters on the landward side of the baselines from which the territorial sea of Malta is measured".*
[63] Ibid Section 4 (1) (b)
[64] Ibid Section 4 (1) (g)
[65] Ibid Section 4 (1) (k)
[66] Ibid section 4(4) and for that purpose fisheries protection officers shall have the powers set out in article 19 of the Act.
[67] Ibid section 4 (5) "The following persons shall be fisheries protection officers for the purposes of this Act: (a) persons designated as fisheries officers by the Director; (b) all members of the Malta Police Force; (c) all members of the Armed Forces of Malta".

that will be subject to land reclamation operations[68]. In fact, no local fishing vessel is to be used for commercial fishing in the Fishing Waters[69] or any area outside the Fishing Waters, where a licence or permit to fish is required under this Act; unless it is entered in the record of fishing vessels[70] and it is so authorised to fish by a licence or permit granted under this Act. It is the Director of Fisheries, who is responsible for the issue, variation, suspension, and revocation of permits and licences for fishing, and equipment used for fishing, aquaculture, transshipment and other activities for which permits or licences are required under this Act.[71]

4.35 If an area subject to exclusive fishing rights is to be used for land reclamation, the Director of Fisheries may revoke such permit or modify it. The person applying for the licence or the licensed person, as the case may be, has the right, by not later than five working days to appeal against the Director's decision by means of a letter addressed to the Minister wherein that person must state the reasons why the decision of the Director should be cancelled or modified.[72]

ii) The Non Harvestable Species

4.36 Apart from preventive measures to combat pollution and the conservation measures for harvestable species, additional measures may be taken for the conservation of non-harvestable marine living resources, in accordance with the LN 311/2006 on Flora, Fauna and Natural Habitats Protection Regulations. These regulations were issued under both the Environment Protection Act and the Development Planning Act; they transform into Maltese legislation, the obligations under the UN Convention on Biological Diversity, the Ramsar Convention on Wetlands, the Bern Convention on European Wildlife and the Bonn Convention on Migratory Species of Wild Animals. The Habitats regulations transpose also the Habitats Directive[73] of the EU. These Regulations are relevant in two aspects: first, whether the sites proposed are considered as protected habitats under LN 311/2006, and secondly, whether any species occurring in the sites are protected species under the same Regulations.

4.37 The 1992 Habitats Directive aims to protect wildlife species and their habitats. Each Member State is required to identify sites of European importance and to put in place a special management plan to protect them, combining long-term preservation with economic and social activities, as part of a sustainable development strategy. These sites, together with those listed under the Birds Directive, make up the Natura 2000 network - the cornerstone of EU nature protection policy[74]. Malta has submitted a list of the proposed Special Areas of Conservation and the sites designated as Special Protection Areas,

[68] Ibid Section 9 (1) (a) (b)
[69] Ibid Section 8 (1)
[70] As established under ibid Section 7
[71] Ibid Section 4 (1) (h)
[72] Ibid Section 39(1)
[73] Directive 92/43/EEC
[74] The Natura 2000 network already comprises more than 18,000 sites, covering over 17% of EU territory, and was due to be completed in 2004. It is co-financed through the Commission's LIFE programme (set up in 1992 to develop EU environmental policy) and other Community finance instruments.

together with information on each site.[75] There are 31 sites identified, 9 of which fall within the area of the Coastal Cliffs of mainland Malta. These 9 sites have been considered as one site, bringing the total of sites being submitted as candidate Natura 2000 sites to 23. The list of these sites (together with the site number given in the database and the map number indicated on the maps) is available and accessible on the MEPA website. None is in the vicinity of the search areas. However any *posidonia* beds in the designated area may be sufficient to qualify the area as an SAC according to Annex I of the LN 311/2006.

4.38 It is to be stressed however that if the Maltese authorities do not declare the areas where there are *posidonia* meadows as SACs the Directive still applies and they are afforded maximum protection under it. This is the interpretation which the ECJ has given of the Directive. Areas where *Posidonia* are protected can only be subjected to development (land reclamation) via a derogation that is granted on the basis of overriding public interest. The wording of the LN 311/2006 seem to imply that the matter is restricted to SACs and in this it is up to the CA to determine whether development is of an overriding public interest the Regulations themselves however refer to the EU Commission's.

4.39 Regulation 19 of LN 311/2006 lays down: -

- (2) If, in spite of a negative assessment of the implications for the site and the Competent Authority being satisfied that there being no alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, which subject to the subsequent sub-regulation, may be of a social or economic nature, the Competent Authority may give its consent for the operation or activity to be carried out.
- (3) Where the Competent Authority gives such consent under this regulation, shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.
- (4) Where the SAC concerned hosts a priority natural habitat type and, or a priority species, the reasons referred to in the previous sub-regulation must be either:-
- (a) reasons relating to human health, public safety or beneficial consequences of primary importance for the environment, or
- (b) other reasons which in the opinion of the Commission are imperative reasons of overriding public interest."

4.40 MEPA is the competent authority responsible for imposing conditions for the conservation of non-harvestable species, for their monitoring and enforcement. It is important to note that these lists and information related thereto are continuously being updated by the competent authority on receipt of additional data. This exercise is considered as an ongoing process, and as such relevant information will have to be updated accordingly when necessary. In this context, therefore, land reclamation operations will be scrutinised

[75] The information includes a map of the site, its name, location, extent and the data resulting from the application of the criteria specified in Annex III of this Directive, all provided in a format established by the Commission as presented in Commission Decision 97/266/EC.

at the strategic phase to determine whether they are permissible given the possible negative impacts the operations may have on these sites.

4.41 Section 9(1) of LN 311/2006, in fact, provides for areas eligible for identification as SACs of national or of international importance, where on the basis of the criteria set out in Schedule IV (Stage 1) to these regulations and relevant scientific information, the Competent Authority," *shall, from time to time, propose a list of sites indicating with respect to each site which natural habitat types in Schedule I to these regulations and which species in Schedules II and III to these regulations that are native to Malta are hosted by the sites in question."* Although the search areas have not been designated as SACs, they may be so in the future and thus calls for stricter controls on the part of Competent Authority to grant development permits. It must be pointed out that a proviso to this regulation 9(1) provides for some leeway in this respect. It states: "*Provided also that for aquatic species, which range over wide areas, such sites will be proposed only where there is a clearly identifiable area representing the physical and biological factors essential to their life and reproduction".*

4.42 If this is so, there is an exemption clause that may be applied. Even if such a site would be considered to be a candidate for an SAC, Regulation 19 may provide an exemption.

4.43 *"19. (1) Where it appears to the Competent Authority that an application for consent under these regulations relates to an operation or activity which is or forms part of a plan or project which:–*

- is not directly connected with or necessary to the management of the protected site, and
- is likely to have a significant effect thereon, either individually or in combination with other plans or projects, the Competent Authority shall make, or require the applicant to make, an appropriate assessment, of the implications of the operation or activity on the site in view of the site's conservation objectives.

4.44 In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of sub-regulation (2) of this regulation, the Competent Authority may give consent to the operation or activity only after having ascertained that the plan or project will not adversely affect the integrity of the site concerned and if appropriate, after having obtained and taken into account the opinion of the general public and representations made within such reasonable time as the Competent Authority may specify.

4.45 (2) If, in spite of a negative assessment of the implications for the site and the Competent Authority being satisfied that there being no alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, which subject to the subsequent sub-regulation, may be of a social or economic nature, the Competent Authority may give its consent for the operation or activity to be carried out.

4.46 (3) Where the Competent Authority gives such consent under this regulation, shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.

4.47 (4) Where the SAC concerned hosts a priority natural habitat type and, or a priority species, the reasons referred to in the previous sub-regulation must be either:-

4.48 (a) reasons relating to human health, public safety or beneficial consequences of primary importance for the environment, or

4.49 (b) other reasons which in the opinion of the Commission are imperative reasons of overriding public interest."

4.50 Development permission for land reclamation operations would be subjected to the provisions of LN 311/2006. Although, from a habitat conservation point of view, if the area for land reclamation falls within an SAC, it can still be given permission for reasons of overriding public interest. This is unlikely to be acceptable due to the presence of species listed in Schedules V(a) (b) and VI(a)(b) of LN 311/2006. Development permission may be stalled if no measures can be taken to conserve the protected species from being damaged or destroyed if they occur in the areas where land reclamation would take place.[76]

Legal obligations to inform and consult other States and International Organisations and laws providing access to information to the general public and public participation in decision-making

The Applicable Sources

International treaties

- 1982 United Nations Convention on the Law of the Sea: Article 205,
- 1998 Aarhus Convention on Access to Information, Public Participation and Access to Justice in Environmental Matters.

National Legislation

- Chapter 356 Development Planning Act
- Chapter 435 Environment Protection Act
- LN 116/2005 Freedom of Access to Information on the Environment Regulations
- LN 418/2005 Strategic Environment Assessment Regulations
- LN 74/2006 Plans and Programmes Public Participation Regulations
- LN 114/2007 Environment Impact Assessment Regulations.

[76] Vide Regulation 24 (1) No person shall deliberately pick, collect, cut, uproot, destroy or damage in any way any specimen of species of flora listed in Schedules V (b) and VI (b) to these regulations." Similarly Regulation 25 (1) protects animal species occurring in Schedule V (a) and VI(a).

The Legal Obligations

4.51 The Maltese government is not legally constrained to inform neighbouring States on land reclamation projects carried out *within Malta's internal waters* because the operations would be conducted within areas that are exclusively subject to its jurisdiction. Nevertheless it would be obliged to do so under International law, if effects of land reclamation may be even remotely felt beyond Malta's territorial jurisdiction. This is in fact what UNCLOS provides.

4.52 Under UNCLOS, States are obligated to inform and notify other States and the competent International Organizations of any imminent danger of the marine environment being damaged or instances where it has been damaged by pollution. This part of UNCLOS also obligates States, "*to keep under surveillance the effects of activities, which they permit or in which they engage in order to determine whether these activities are likely to pollute the marine environment*"[77] and to publish regular reports on the results thus obtained that will be forwarded to competent international organizations, which in turn should make these available to all States[78]. Such information should include also an assessment of the potential effects of such activities.[79] Recently, a dispute between Malaysia and Singapore before the International Tribunal for the Law of the Sea dealt with land reclamation operations carried out by Singapore in its territorial sea and which, according to Malaysia was in breach of UNCLOS because Singapore had failed to inform and consult with it. The tribunal held that Singapore was in fact obliged to inform and consult with Malaysia, even if Singapore could carry out land reclamation operations within its territorial sea.

4.53 Malta's membership within the European Union must also be taken into consideration to determine whether Malta is obliged to carry out transboundary consultations and to inform other States particularly EU member States in this respect, because of obligations arising from the EIA[80] and the SEA[81] Directives. These Directives favour exchange of information and consultation in a transboundary context even if the land reclamation operations are limited to the internal waters.

4.54 The Aarhus Convention and the Access to Information Regulations transposing the Convention and the Directive bearing the same name, render it obligatory for the competent authority, in this case MEPA, to facilitate public participation and to provide access to environmental information on a land reclamation the project. There are only few exceptions when the information may be legally withheld and, at any rate, the competent authority is duty bound to provide extracts of information in so far as these would not prejudice those exemptions. Any person has the right to ask for information without having to prove a direct interest.

[77] UNCLOS Article 204 (2)
[78] Ibid Article 205
[79] Ibid Article 206
[80] Directive 85/337 on Assessment of the Effects of Certain Public and Private Projects on the Environment
[81] Directive 2001/42 Assessment of the Effects of Certain Plans and Programmers on the Environment

4.55 Public participation sessions on a national and transboundary level are provided for under both the EIA[82] and the SEA regulations.

4.56 The SEA Regulations (LN 418/2005) transpose the Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment. The Directive stipulates that results of consultations must be "*taken into account*". It leaves it up to the member states to devise the manner by which this should be done, but in order to avoid duplication of assessment it reiterates the need to integrate the process with assessments required under other Community legislation,. The process proposed under LN 418/2005 aims to integrate, streamline and expedite these processes as much as possible.

4.57 The SEA Regulations state that transboundary consultation should take place if the development or plan / programme is likely to have "*significant environmental effects on the environment in another State".* Given that the proposed land reclamation projects are coastal projects, it is unlikely that such transboundary consultation would be required. This, however, would still be the Competent Authority's responsibility in the case of SEA.[83]

4.58 LN 418/2005. in line with the EU SEA Directive. also imposes an obligation upon the competent authority to enter into transboundary consultations with other affected EU member States. The SEA Audit Team, as the Competent Authority*, "prior to the adoption of the plan or programme or its submission to the legislative procedure for adoption, shall seek to enter into consultation with the Designated Authority of the State concerned in respect to: (a) the likely effects of the implementation of the plan or programme on Malta. (b) a copy of the relevant environment report (c) relevant information regarding the strategic environmental assessment procedure (d) information on the nature of the decisions which may be taken".* The Competent Authority is to give the Designated Authority of the other Member State, eight weeks or any other reasonable time in agreement with the proponent and the affected State in question, in which to indicate whether it wishes to enter into consultations before the adoption of the plan or programme or its submission to the legislative procedure. If the Designated Authority of the other Member State indicates that it wants to enter into consultations, the Competent Authority is to ensure that the affected Member State would be able to enter into such consultations concerning the likely transboundary effects of the plan or programme and the measures envisaged to reduce or eliminate such effects.[84] During the preparation of the plan/programme, the proponent must take into account the results and findings of the strategic environment report, the opinions expressed by the relevant authorities, the stakeholders and the public as well as the results of any transboundary consultations. This must always be done before the plan/programme concerned is adopted.

4.59 Once the plan / programme is adopted, the member state responsible is to inform all the parties that have been involved in the consultation. The plan or programme as adopted; a statement summarising how environmental considerations have been integrated, the

[82] LN 74/2006 Plans and programmes Public Participation Regulations.
[83] See Article 13 of LN 415 of 2005
[84] LN 418/2005 Regulation 13

strategic environment report; the opinions and the results of consultations; the reasons for choosing the plan or programme as adopted and the planned monitoring measures will also be made available.

4.60 Malta is only legally bound to enter into consultation with EU member States. It is not a Party to the SEA Protocol[85], which provides for transboundary consultations in SEAs amongst the State parties.

4.61 The EIA Regulations that transpose Directive 85/337 also provide a framework for transboundary consultation. Such consultation should take place if the development that requires an EIA is likely to have "significant environmental effects on the environment in another State"[86].

Legal obligations and laws regulating impact assessment at the strategic and later on at the implementation level of the project

The Applicable Legal Sources

National Legislation

- Chapter 356 Development Planning Act
- Chapter 425 Environment Protection Act
- LN 418/2005
- LN 114/2007

The Legal Obligations

4.62 The SEA Regulations identify those plans and programmes that are liable to have significant effects on the environment and which, therefore, require a strategic environmental assessment. The Regulations ensure that this assessment is carried out at the very beginning of the plan/programme, which is referred to as the strategic phase. SEA compliments the existing Environmental Impact Assessment (EIA) process for projects introduced by Directive[87] (the Assessment of the Effects of Certain Public and Private Projects on the Environment (EIA)).[88] The EIA Directive is transposed into national legislation as LN 114/2007, which repealed LN204/2001 entitled Environment Impact Assessment Regulations.

[85] The Protocol is not yet in force and it is issued under the auspices of the Economic Commission for Europe.
[86] See Article 34 of LN 114 of 2007
[87] 85/337 EEC Official Journal L 175 of 5.7.1985.
[88] The EIA introduced a system within the member states for prior assessment of the possible effects of public and private projects on the environment.

4.63 The EIA Regulations address construction projects and other installations or schemes, as well as other measures affecting the natural environment or landscape. EIAs must be carried out at the development planning stage. On the other hand, the SEA Regulations introduce a system of environmental assessment at the strategic phase but only on public plans and programmes, which are within their scope. The Regulations apply only to plans and programmes[89] and any amendments made to them. In order to be subject to an SEA, public plans/programmes must fulfill *all* the following conditions:

- Be prepared and/or adopted by a competent authority or prepared by a competent authority for adoption by means of a legislative procedure;
- Be required by legislative, regulatory or administrative provisions;
- Be liable to have significant effects on the environment;
- Either propose future developments that may require an EIA in one or more of the following sectors: town and country planning or land use, transport, energy, waste management, water management, industry, telecommunications, agriculture, forestry, fisheries tourism **or** require an assessment under the Habitats Directive (transposed as Legal Notice 204/2001); and
- Have started after 21 July 2004.

4.64 For the land reclamation project to be subject to an SEA it must fulfill all of the above-mentioned conditions. A plan/programme will be exempt from an SEA if:

- The sole purpose of the plan / programme is to serve national defence or civil emergency or refer to financial and budget plans such as the national budget estimates, even if it fulfils the above mentioned conditions.
- There is no significant environmental effect because only a small area is being affected or only a minor modification in the plan / programme is taking place.

4.65 It does not appear that land reclamation operations would fall under the exemption clause and, therefore, an SEA would likely be required for land reclamation projects. Notwithstanding, the SEA competent authority[90] will be responsible for deciding whether an SEA is required.

4.66 The Environmental Impact Assessment Regulations (LN 114 of 2007) require that an Environmental Statement is prepared for projects that fall within Schedule I of the Regulations. Depending on the nature and scale of the development an Environmental Planning Statement (EPS) or an Environmental Impact Statement (EIS) is required. The latter is required for projects that are considered to have more of an impact than those that require an EPS. In the case of an EIS, a public hearing / meeting is held at the end of the process where the findings of the EIS are discussed. This meeting is not held in the case of an EPS.

[89] Including those financed by the European Community
[90] In Malta's case the Competent Authority is the SEA Audit Team with MEPA's Environment Assessment Team as its operative arm.

4.67 Schedule I of the Regulations identify those projects that are required to undergo the EIA process. Land reclamation projects are listed in Section 4 of the Schedule. Land reclamation projects having an area of more than 1 hectare are required to prepare an Environmental Impact Statement; those having an area of more than1,000 m^2 would require an Environmental Planning Statement.

Legal remedies providing access to information, participation and access to justice in environmental matters and environmental liability

The Applicable Legal Sources

International obligations

- 1998 Aarhus Convention on Access to Information, Public Participation and Access to Justice in Environmental Matters.

National Legislation

- LN 116/2005 Freedom of Access to Information on the Environment

Regulations

- Code of Organisation and Civil Procedure, Article 469A
- Chapter 435 Environment Protection Act, Article 24
- Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on Environmental Liability with regard to the prevention and remedying of environmental damage (The Environmental Liability Directive)

The Legal Obligations.

Access to Information in Environmental Matters

4.68 Legal Notice 116/2005: The Freedom of Access to Information on the Environment Regulations, guarantee that anybody, without having to prove an interest, has the right of access to environmental information held by or for public authorities. These regulations set out the basic terms and conditions of and practical arrangements for the exercise of such access to information. These Regulations ensure that environmental information is progressively made available and disseminated to the public in order to achieve the widest possible systematic availability and dissemination to the public of environmental information. These regulations implement the Right of access to information as provided under the Aarhus Convention and Directive 2003/4EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information.

Access to Justice in Environmental Matters

4.69 Although Malta has both a general as well as a more specific remedy that provides for access to justice via judicial review for environmental issues, it is not fully in line with the provisions of article 9 (3) of the Aarhus Convention and with the Directive that transforms the legal obligations that EU member States must provide on a national level. The importance of harmonising national law with the Aarhus Convention and the *acquis communautaire* in this respect cannot be underestimated when considering the feasibility of carrying out a land reclamation project, since the project would fall within the scope of the right of access to justice on environmental matters for both individuals and NGOs. The Maltese authorities have acknowledged that there is this gap and have issued public statements that the matter is currently being subjected to a legal exercise that would eventually harmonise Maltese legislation with the Aarhus Convention and the related Directive.

4.70 The available remedy consists of a general provision under the Code of Organisation and Civil Procedure (COCP), Article 469A that provides for the judicial review of any act by the public sector. This legal provision does not only apply to violations of environmental law, but to all administrative actions carried out by the public sector in general. The provisions of Article 9(3) of the Aarhus Convention can, at present, only be exercised under Article 469A of the Code of Organisation and Civil Procedure (COCP), entitled, "Judicial Review of Administrative Action".

- Article 469A can be applied in the case of a Land Reclamation Project when an individual requires the Law Courts to: "enquire into the validity of any administrative act or declare such act null, invalid or without effect," because the administrative act is ultra vires on any of the following grounds:
  - (i) when such act emanates from a public authority that is not authorised to perform it; or
  - (ii) when a public authority has failed to observe the principles of natural justice or mandatory procedural requirements in performing the administrative act or in its prior deliberations thereon; or
  - (iii) when the administrative act constitutes an abuse of the public authority's power in that it is done for improper purposes or on the basis of irrelevant considerations; or
  - (iv) when the administrative act is otherwise contrary to law".

4.71 The relevance of this provision to a development or any other permit issued for the carrying out of a land reclamation project lies in the fact that under this article, "Administrative act" includes the issuing by a public authority of any order, licence, permit, warrant, decision, or a refusal to any demand of a claimant91. Furthermore, "public

[91] This definition under article 469A also provides that saving those cases where the law prescribes a period within which a public authority is required to make a decision, the absence of a decision of a public authority following a claimant's written demand served upon it, shall, after two months from such service, constitute a refusal for the purposes of this definition.

authority" is here defined as the Government of Malta, including its Ministries and departments, local authorities and any body corporate established by law.

4.72 Under the COCP article 469A, an action to impugn an administrative act shall be filed within a period of six months from the date when the "*interested person*" becomes aware or could have become aware of such an administrative act, whichever is the earlier. The provisions of this article shall not apply where the mode of contestation or of obtaining redress is provided for in any other law. In any action brought under this article, it shall be lawful for the plaintiff to include in the demands a request for the payment of damages based on the alleged responsibility of the public authority in tort or quasi tort, arising out of the administrative act. The court shall not award the said damages, where notwithstanding the annulment of the administrative act, the public authority has not acted in bad faith, or unreasonably, or where the thing requested by the plaintiff could have lawfully and reasonably been refused under any other power.

4.73 The COCP, therefore, provides a general right to access to justice to any "*interested party*" to ask the courts to review the validity of administrative act or the breach of any law. It is a general remedy, but actually more valid when it comes to the application of Article 9(3) of the Aarhus Convention because the environment-specific remedy provided by article 24 of the EPA allows only the Chairman of the Environment Fund to institute an action for environmental damages when environmental laws are breached. The wording of article 24 also obligates the Chairman to take such action on behalf of the government. This prevents the Chairman from acting when the public institution involved is the government itself. It can only proceed when the public institution has a separate juridical personality that is distinct from the government.

4.74 There exists under the EPA, however, a possibility to initiate a judicial procedure alleging violation of environmental law. The Chairman of the Environment Fund has the right to institute an action for damages on behalf of the government against any person who breaches environmental laws. Since it is the government that would probably undertake any land reclamation project, the Chairman of the Environment Fund would not be in a position to act since he can only institute an action for environmental damages on the government's behalf. Only the Chairman of the Fund under the EPA can institute this action for environmental damages, such an action would be in addition to other civil and criminal actions to which a breach of environmental law gives rise. The Chairman of the Environment Fund has a more limited role than that required by the Aarhus Convention with respect to access to justice.

The Environmental Liability Directive

4.75 This Directive[92], which came into force in all Member States on the 30th April 2007, has various legal and administrative implications. To date it has not been transposed into Maltese national legislation. Environmental liability is a form of liability that is separate from and is additional to civil and criminal liability. Its purpose is to award damages for harm caused to the environment *per se*, and the fines paid would be used to reinstate the environment that has suffered such damages. The term damage itself is defined as

[92] Directive 2004/35/EC

measurable adverse change in natural resources, measurable impairment of a natural resource service, which may occur directly or indirectly.

4.76 This concept already exists under the Environment Protection Act, which stipulates that an action for environmental damages may be made whenever there is a breach of environmental law i.e. a breach of the Act or the regulations issued there under. It has, however, never been applied, basically because an action for environmental liability under current Maltese law can only be initiated at the discretion of the Chairman of the Environment Fund and the chairman has to this day never taken such an initiative. The Directive, however, goes beyond this and, in a nutshell, stipulates that operators who conduct certain activities are liable and must pay for such environmental damages if damage to the environment ensues. In some cases, when operations conducted fall under Annex III [93]of the Directive, any liability incurred would be strict. In all other cases, it is based on tort or negligence. If the operators do not take the necessary steps, the competent authority should take these steps itself and recover expenses from the operator apart from claiming from him environmental damages.

4.77 The Directive introduces various legal provisions that are extraneous to the way liability arises and damages are awarded under the Maltese legal system. The following changes have to be made to the law:

- An action for environmental damages becomes mandatory and would no longer depend upon the discretion of the Chairman of the Environment Fund but must be initiated once damage has occurred;
- Furthermore, since the Directive aims at prevention, liability arises even if there is an imminent threat that such environmental damage would occur. Under the Environment Protection Act for the Chairman of the Fund to initiate proceedings for environmental damages the harm must have occurred;
- In the case of occupational activities listed in Annex III to the Directive, which cause or pose an imminent threat to cause environmental damage, liability for environmental damages is strict, as opposed to the present system of liability based on tort / negligence. There are, however, cases when liability is not strict under the Directive. Land Reclamation projects do not, in fact, fall under Annex III and hence any environmental damages would be based proof of any tort and/or negligence on the part of the operators;
- The Directive shifts the onus of proof on the operator;
- It will impose an obligation upon the competent authority to enter into third party property, to rectify or prevent the threat of imminent damage if the operator fails to do so, cannot be identified or is not required to do so under the directive; and
- It will require amendments in our present legal system to enable even NGOs as well as natural and legal persons to have legal standing and oblige the competent authority to institute an action for environmental damages.

[93] Landfills, composting plant, transfer station, IPPC Installations, Shipyards, Energy Industries, Power stations, Large farms, Laboratories and institutions dealing with GMOs

4.78 The Directive obligates operators of occupational activities to bear costs for preventive and remedial measures taken in accordance with the Directive. Such costs may be covered by financial guarantees before the operator starts activity. This system, however, is not new for Malta as it is already applied in practice because, under the Environment Protection Act and the Development Planning Act, there is the *vires* to include it in the granting of licenses for various activities, which have an impact on the environment. There are instances where the operator is exempted from bearing costs, but the onus of proof is on him. If he is exempted the competent authority must provide for measures whereby he can recover these costs.

4.79 Presently, the Environment Protection Act establishes a non-mandatory action for environmental damages in case of a breach of the provisions of the Act and the regulations issued thereunder. The Directive, as mentioned above, provides for a mandatory action for environmental damages, albeit in seemingly more restricted circumstances. Under the Directive, environmental liability arises in the case of environmental damage. Such damage would be highly possible in the case of land reclamation operations, namely damage to:

- Protected Species and their Habitats as stipulated under the Birds and Habitats Directives (except where derogations have been granted under the Directive);
- Water Resources as stipulated under the Water Framework Directive; and
- Land, when creating a significant risk that may adversely affect human health as a result of direct and indirect introduction in, on or under land of substances, preparations, organisms, and micro-organisms.

4.80 Although not yet transposed in Maltese law, Malta is bound by this Directive. Any feasibility study for land reclamation operations must, therefore, consider this Directive as an applicable legal source.

A monitoring and enforcement regime to ensure conformity with the applicable laws

The Applicable Legal Sources

- All legislation discussed in preceding sections of this report.

The Legal Obligations

4.81 All legal instruments that have been mentioned above provide for monitoring and enforcement; compliance and enforcement measures are inherent to any legal obligation. UNCLOS provides that national laws should also provide for enforcement of applicable international rules, "*established through competent international organizations or diplomatic conference to prevent reduce and control pollution of marine pollution arising*

from or in connection with seabed activities subject to their jurisdiction."[94] The same obligation applies to coastal States with respect to dumping in their territorial sea or beyond[95]. This provision exonerates the coastal State from taking such enforcement measures when dumping activities are conducted on the seabed of the internal waters but, as described, the Protocol to the London Dumping Convention also addresses, albeit not in a mandatory manner, this issue. Furthermore, as land reclamation would fall outside the scope of the definition of dumping and would, therefore, not be regulated as such. These provisions would only become applicable if the placement of inert matter on the seabed for land reclamation operations would lead to ancillary dumping operations. In which case, national legislation regulating dumping provides for compliance and enforcement measures. Article 235 provides that States are liable under International law if they do not fulfil their obligations to preserve the marine environment, and must ensure that they provide recourse under their own legal systems for, "*prompt and adequate compensation in respect of all damage caused by pollution of the marine environment by natural or juridical persons under their jurisdiction."*[96]

4.82 With respect to all the other obligations, especially those emerging from national legislation, all the Acts of Parliament and legal notices provide for monitoring and enforcement measures[97]. Most breaches constitute a criminal offence. Both the EPA and the DPA provide for an elaborate enforcement regime with enforcement officers that have wide powers. Furthermore, most examples of national legislation impose also self-compliance by stipulating conditions and setting thresholds that must be met. The SEA regulations would describe the kind of monitoring that must be undertaken, whilst subjecting the Land Reclamation project to an EIA would generate findings that eventually the competent authority(ies) would take into account when formulating development and any other permits.

[94] Ibid Article 214
[95] Ibid Article 216
[96] Ibid Article 235 (2)
[97] The only exception is LN 418/2005, the SEA Regulations, that provide for monitoring but do not establish penalties for non compliance since they are exercisable against the public sector.