# MAGHTAB SORTING YARD

# ENVIRONMENTAL PLANNING STATEMENT

**FINAL REPORT**

**JULY 1996**


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# MAGHTAB SORTING YARD

# ENVIRONMENTAL PLANNING STATEMENT

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## 5.0 POST COMPLETION AUDIT

# NON TECHNICAL SUMMARY

## Introduction

This Environmental Planning Statement has been prepared by Rust Environmental in association with Advanced Industrial Systems Ltd (AIS) to accompany a planning application by Green Skips Services Limited for the erection and operation of a public waste utility site at Maghtab, Malta.

The assessment of environmental impacts of the proposed development has been undertaken in accordance with the Policy and Design Guidance, Environment Impact Assessment in Malta by Rust Environmental, a multi disciplinary environmental consultancy. The consultancy team was comprised of specialists in environmental science, waste management, planning, acoustics and landscaping. The ecological survey was undertaken by Messers Stevens, Mifsud and Tabone. The hydrological appraisal was conducted by AIS while archaeological studies were conducted by the Museums Department with additional information supplied by the Environmental Management Unit.

## The Site and the Proposed Development

The proposed public waste utility site will be located near to the entrance of the Maghtab Landfill and will be operated by Green Skips Services Ltd under directions received from the Environmental Protection Department. The development will also include a waste reclamation site and servicing yard that will be managed and used by Green Skips Services Ltd.

The development will provide the operators with the necessary base from which to operate its expending services within the waste management field. The project will also encourage the Maltese community to segregate and recycle materials that would otherwise go directly to the Maghtab landfill site.

The proposed development will consist of two principal areas; one area will be developed as a public waste utility site and one as a waste reclamation site. The building and facilities

on site will consist of the following; office accommodation, garage, reclamation area, skip ashing facilities, walled sheds and areas for storage of recyclable waste. Wastes that will be recovered will include glass, cardboard, plasters and metals. No hazardous wastes will be handled at the site.

It is envisaged that between 10 and 12 full time staff will be employed at the site.

**Environmental Impacts**

Air Quality

Impacts on air quality have been assessed and no major concerns have been identified.

Water Quality

Water quality impacts have been predicted to be of minimal significance as a result of the design measures that will be incorporated as part of the development. Effluent will be disposed of to the sewerage system while storm water will be recovered and reused where appropriate; a number of beneficial impacts have been identified as a result of the development proceeding.

Ecology

The site is currently severely disturbed and of minimal ecological importance. No major impacts were noted and some improvements were likely as a result of the landscaping proposed for the site.

Visual Impact

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Considerable improvement in the visual and landscape environment has been predicted as a result of the development. The site is currently acting as an adhoc storage area and is untidy; it will be improved significantly through purpose built buildings and a planted site boundary.

Traffic Impacts

The development has been identified as not increasing the number of vehicles using the public roads leading to the site and as a consequence impacts will be minimal.

Archaeology

The study has identified the presence of a valuable nearby archaeological monument (the Maghtab Tomb Clusters); no direct impacts on the remains will occur and measures have been included within the design that will aid access to the archaeological site. The redevelopment of the site will also improve greatly the visual appearance of the general area.

Health and Safety and Vermin

The development of a code of practice for the site will ensure health and safety impacts are minimised. No vermin or pests will be expected to be attracted to the site as no organic waste will be handled at the site.

Noise

It is not expected that significant noise will be generated by the facility and the distance to any residential houses indicates that noise impacts will not occur.

**Summary**

This Environmental Planning Statement has considered the siting of the proposed development and the operations that will take place on the site. Environmental impacts have been identified in all cases to be minimal significance and can be reduced further through incorporation of mitigation measures. It is therefore considered that the environmental impacts during the construction and operation of the facility will be minimal.

# 1.0 INTRODUCTION

## 1.0 INTRODUCTION

### 1.1 Background

1.1.1 The Development Planning Act 1992 requires that permission is sought from the Planning Authority for all development activities by both private developers and Government Departments and Agencies. The development of a Sorting Yard at Maghtab is classed as a Category 2 project requiring an Environmental Planning Statement (EPS) rather than a full Environmental Impact Assessment (EIA).

1.1.2 The EPS is submitted in support of an application by Green Skip Ltd. who are seeking permission for the development and operation of a public waste utility site, a waste reclamation site and a service yard in Maghtab, Malta. The EPS has been prepared by Rust Environmental and Advanced Industrial Systems Ltd.

1.1.3 Green Skip Ltd has been operating a solid waste collection service from industries for over 3 years and have become one of the principal operators within Malta. They operate 3 vehicles and service over 45 factories using 80 industrial skips and 50 wheeled bins.

### 1.2 Alternative Site Study

1.2.1 Green Skip Ltd has considered a number of alternative sites for the siting of the sorting yard. The site which this EPS addresses is considered to be the most suited for the nature of the development.

1.2.2 It was considered that the development should be situated as close to the Maghtab Landfill as possible. As the use of a landfill is an integral part of the waste sorting process, locating this development in the vicinity of the

Maghtab Landfill was considered a significant advantage. Furthermore, the area is already associated with waste management and this development would be in line with the national waste management strategy. Consequently a site at Wardija was ruled out.

1.2.3 Another site which was considered was situated on the outskirts of Burmarrad/Maghtab. The area of this land was around 6,000 square metres. An application to develop this site as raised in June 1992. (Ref. Land Department: 7617) but the site was considered not large enough for the development being sought.

1.2.4 Another site located just off the road leading from the Coast Road to the Maghtab landfill was also considered. The area of this land was circa 7 tumoli. The ownership rights on this land however turned out to be doubtful and, although in closer proximity to the Maghtab Landfill, could therefore not be considered further.

1.2.5 An area within the Maghtab landfill was then identified for possible development. As this land as government property, a request to lease this land was addressed to the Lands Department in March 1993. (Ref. Land Department:2957). This request was denied in May 1993 and the present site was subsequently identified.

1.2.6 The proposed site is adjacent to the Maghtab Landfill and is privately owned (recently purchased by Green Skip Ltd). The site satisfies the most relevant criteria for a site selection in view of the requested development, namely;

- The site is close to the Maghtab Landfill
- Ownership of the site is with the developer

- There are no residential settlements in the vicinity of the site or its surrounding area
- The development is in line with the dominant activity of the area
- The site is ecologically disturbed
- No significant archaeological or architectural features are present on the site
- No agricultural activity is possible on the site, whilst only limited agricultural activity exists in the surrounding areas

1.2.7 Although the main argument in favour of this site is its vicinity to the Maghtab Landfill, as with all landfills, this has a lifetime. No official estimates however exist on the expected lifetime of this landfill, but it is understood that it will be some years before the Maghtab Landfill will become closed.

1.2.8 Measures are already underway to identify the site for the next landfill. As it is currently understood, disposal of construction and demolition waste which amounts to close to 80% of all waste generated in Malta will not be directed to the new landfill. This waste management issue has to be addressed prior to the new landfill being fully operational. Therefore the closure of the Maghtab Landfill is heavily dependent on the new landfill being fully operational with some major waste management issues to be resolved.

1.3 Scope of the Environmental Planning Statement

1.3.1 The scope of this EPS has been derived in accordance with the "Policy and Design Guidance, Environmental Impact Assessment in Malta" document and

the Terms of Reference set by the Environment Protection Department and the Planning Directorate and includes the following sections:

**Introduction**

This section outlines the background to the proposed project, and the scope of the Environmental Planning Statement.

**Proposed Development**

The proposed facility is described, including layout and design description of processes taking place, operational issues and safety and management procedures.

**Overview of Existing Environment**

The physical characteristics of the site are described including site location and description, landuse, landscape, flora and fauna, human aspects, water resources and air quality.

**Assessment of Environmental Impacts and Outline of Mitigation Measures**

A brief assessment of the potential effects of the proposed development on the environment and human beings is presented in this section. The following areas of possible impact have been included:

- Air quality impacts
- Water quality and effluent disposal

- Ecological impacts
- Visual and landscape impacts
- Traffic impact
- Landuse impacts
- Archaeological impact
- Health and Safety and Vermin

An outline of appropriate measures adopted or proposed to mitigate any of the identified effects are also described in this section and their efficacy assessed.

**Audit Monitoring Programme**

An audit monitoring programme has been recommended in order to confirm inclusion of mitigation measures and provide an early indication of the failure of any environmental controls. The audit programme will address monitoring requirements for:

- air quality
- water pollution
- landscaping
- noise

# 2.0 PROPOSED DEVELOPMENT

## 2.0 PROPOSED DEVELOPMENT

### 2.1 Introduction

2.1.1 This section describes the proposals for a waste treatment and recycling centre at Maghtab, Malta. An outline design for the proposed development has been prepared by Paul Camilleri and Associates, Valletta, Malta and is illustrated in Figures 2.1.1 and 2.1.2.

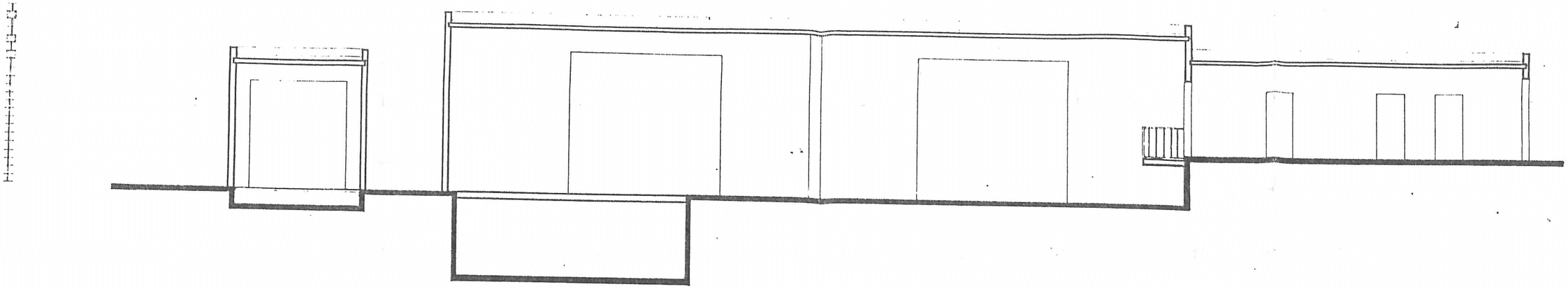
2.1.2 The facility design details on which this document is based have been taken from a letter dated 17 January 1995 to the Planning Directorate, Floriana, Malta from Mr Paul Camilleri.

2.1.3 Green Skip Ltd. offers a waste collecting service to the local manufacturing industry. All waste collected is presently disposed of at the Maghtab Landfill. This development would allow for the sorting of this waste (which would have otherwise been landfilled), into adequate and economical shipping/transporting loads to be recycled at specialised facilities. Recycling would be carried out in other facilities, mostly situated abroad. The sorting process to be adopted at this facility will be similar to the standard acceptable manner used throughout Europe.

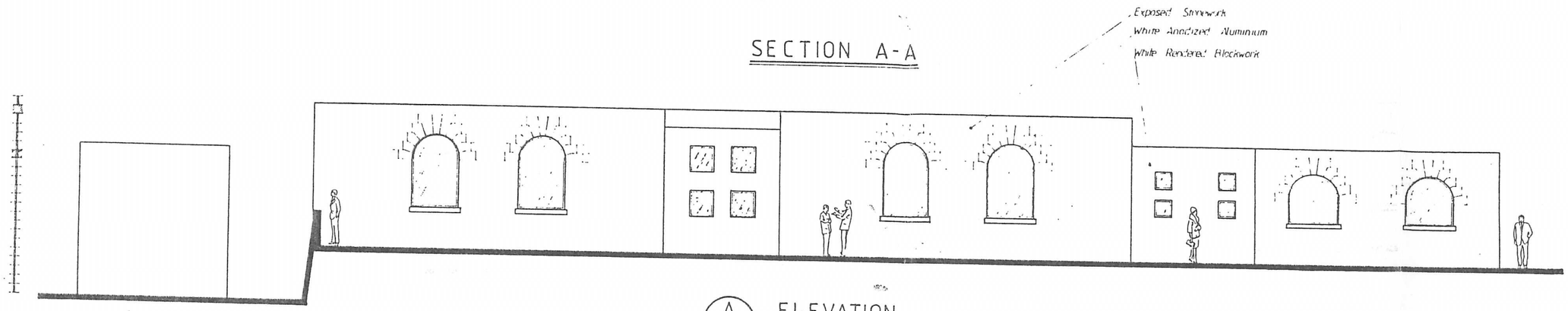
2.1.4 The proposed service is in line with the Waste Management Strategy adopted by the Environmental Protection Department as is the sites economical feasibility with the envisaged introduction of levies and tariffs for the disposal of un-recyclable and un-reusable waste.

### 2.2 Facility Concept

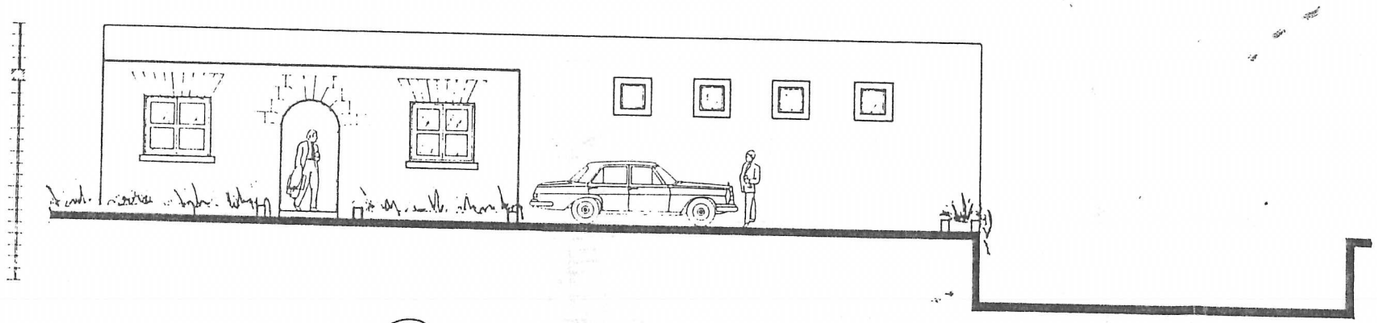
2.2.1 The facility will primarily function in two main ways; firstly, the provision of a Public Waste Utility Site and, secondly, the provision of a Waste



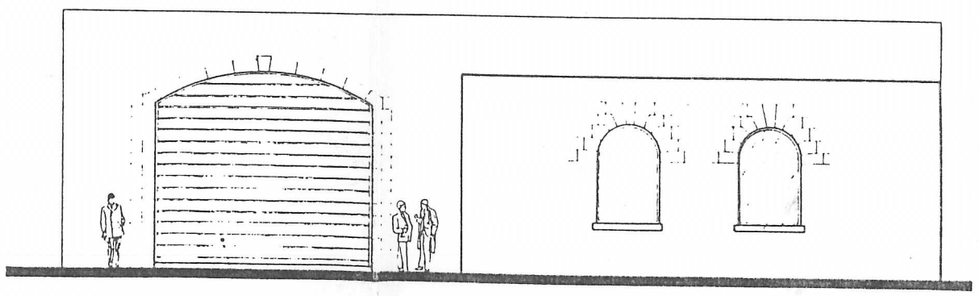
SECTION A-A



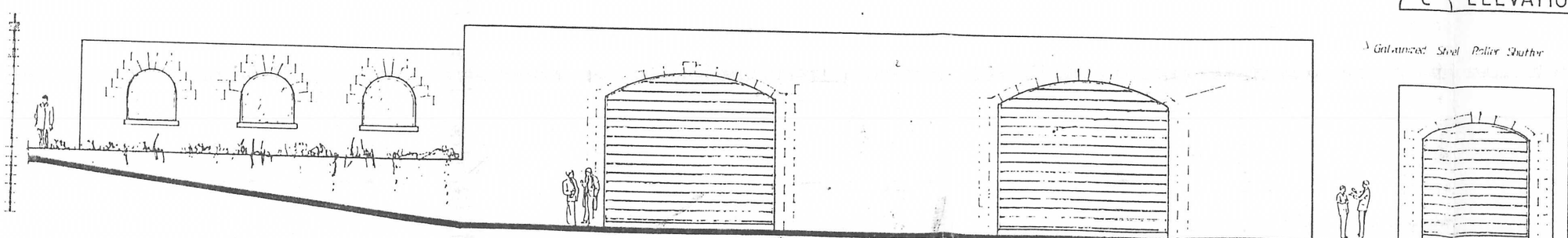

A ELEVATION



B ELEVATION



C ELEVATION




D ELEVATION

Advanced Industrial Systems

Rust Environmental

MAGHTAB SORTING YARD

Proposed Elevations & Sections

| | |
|---|---|
| Figure No. 2.1.2 | Scale : N.T.S |
| Project No.EEMBL099 | Drawn By : N.L.G |

PRIVATE ROAD

SECONDARY ENTRANCE

BINS

SKIP STORAGE

ASPHALT

Sediment Tank

BALING AREA

CONCRETE

Control Room

Covered Area For Sorting

GLASS CRUSHER

WASHING OF SKIPS

UNDERGROUND RESERVOIR

GARAGE

Cess-Pit

OFFICE

OFFICE

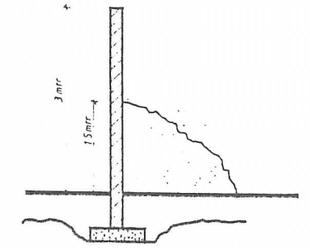
OFFICE

WC

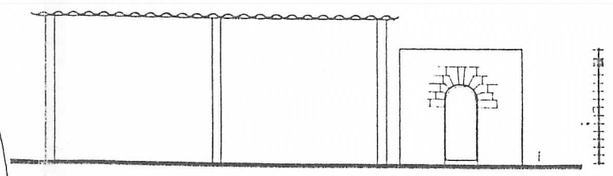
KITCHEN

WAITING AREA

MAIN ENTRANCE




SECTION B-B



E ELEVATION

Advanced Industrial Systems

Rust Environmental

MAGHTAB SORTING YARD

Site Layout

| | |
|---|---|
| Figure No. 2.1.1 | Scale : N.T.S |
| Project No.EEMBL099 | Drawn By : N.L.G |

Reclamation Site. The development will also include a Service Yard for use by Green Skips Services Ltd.

2.2.2 The objectives of the development are as follows:

- to improve and extend the current service of providing skips for use by members of the public wishing to dispose of small quantities of bulky waste;
- to continue to provide separate skips for the segregation of various types of waste and space for related waste recovery services;
- to allow the sorting and accumulation of certain waste types for export to overseas recycling facilities;
- to provide a service yard for Green Skips Services Ltd vehicles and a temporary storage yard for skips.

2.2.3 The development will provide Green Skips Services Ltd with the necessary base from which to operate its expanding services within the waste management field. The project will also encourage the Maltese community to segregate and recycle materials that would otherwise go directly to the Maghtab landfill site. In doing so, the public would be helping to minimise the amount of waste going to landfill in line with the European Community's strategy for waste management.

2.2.4 In order to meet the above objectives, the developer requires more space and adequate facilities to select and store economical quantities of waste for recycling overseas.

## 2.0 PROPOSED DEVELOPMENT

### 2.3 Site Layout and Process Description

2.3.1 The proposed development will consist of two principal areas; one area will be developed as a Public Waste Utility Site and one as a Waste Reclamation Site/Service Yard (see Figure 2.1.1). The Public Waste Utility Site will be managed under directions received from the Environment Protection Department. The Waste Reclamation Site and Service Yard will be managed and used by Green Skip Ltd.

2.3.2 The Public Waste Utility Site will be sited near the entrance to the Maghtab landfill. This area currently houses a number of open skips; these have been provided by the Environment Protection Department for use by members of the public who wish to dispose of small quantities of bulky waste. This area will be levelled and landscaped and used to provide separate skips for the segregation of various waste types (eg. cardboard, wood, glass) and space to allow the undertaking of related waste recovery services.

2.3.3 The Waste Reclamation Site and Service Yard will be located just behind the Public Waste Utility Site and will only be accessible to Green Skip Ltd. personnel and vehicles. The Waste Reclamation Site will be used to sort and accumulate certain types of waste for eventual export to recycling facilities overseas. Reclaimed waste will include items from the skips located in the Public Waste Utility Site as well as items from waste separation and collection schemes elsewhere (primarily from the industrial sector), delivered directly to the site by Green Skip Ltd. vehicles or other means authorised by Green Skip Ltd. The area will also be utilised as a Service Yard for vehicles belonging to Green Skip Ltd. and as a temporary storage yard for skips.

2.3.4 The site measuring approximately 110 metres by 87 metres will be surrounded by a boundary wall (typically of rubble faced construction as suggested by the Planning Department) 3 metres high. An earth berm approximately 1.5 metres high will be constructed against the boundary wall and planted with indigenous plant species. Landscaped areas will be created at various locations within the site.

2.3.5 The following buildings and facilities will be located within the site boundary:

- office accommodation incorporating a waiting area, kitchen, WC and shower. A cess pit will be provided to accommodate the foul waste from the WC and shower;
- garage (incorporating an underground reservoir);
- reclamation area;
- skip washing area;
- walled sheds for storage of waste paper and cardboard;
- parking sheds for refuse vehicles;
- parking spaces for other vehicles;
- area for temporary storage of recyclable waste (for export); and
- areas of landscaping.

The building finishes are illustrated in Figure 2.1.2.

2.3.6 The surface of the site will be laid to fall such that all surface water will be directed to the underground reservoir via a series of drains. Water from the reservoir will be used for the washing and cooling systems required to maintain the operations. Surface water collected in this way will also be used for landscaping purposes. A simple filtration system (consisting of a

simple solids interceptor and oil trap) will enable the water to be recycled and re-used for these purposes. Water used for cleaning trucks and skips will be filtered and reused. Sludge and water which can no longer be filtered will be collected in a cess pit and removed by means of a bowser; this is the same method used for emptying domestic cesspits throughout Malta.

## 2.4 Operational Activities and Facility Management

2.4.1 The processing will predominantly involve additional waste sorting, segregation and temporary storage. On average, it is estimated that on 1 or 2 days per week, compactors and shredders will be used to process the waste. Green Skip Ltd. mainly collect and carry dry, inorganic industrial waste. Separation of materials will take place at source. Only dry inorganic waste will be kept at this site; organic material will be transported to the Sant Antnin Waste Treatment Plant for disposal. All metals will be stored under cover. No hazardous wastes will be handled at the site.

2.4.2 Traffic will enter and leave the site via the existing main entrance.

2.4.3 It is estimated that the following amounts of waste will be collected at the site per annum:

- Glass (various types) - 800 tonnes
- Cardboard - 170 tonnes
- Plastics (various types) - 350-400 tonnes
- Metals (ferrous) - 110-115 tonnes
- Metals (non-ferrous) - 110-120 tonnes

2.4.4 The percentage of each material suitable for recycling is given below:

- Glass - 90-100%
- Cardboard - 55%
- Plastics - approx. 40% (depending on quality)
- Metals - 60-70%

The developer anticipates that, as a result of extra space, the quantity of waste handled at the site will increase. Green Skip Ltd. will, as a result of this expansion, identify and collect from other sources; overseas outlets have already been identified for these materials.

2.4.5 Cardboard and paper will be baled and stacked; a market has already been found for this material. Plastics will be separated according to type and shredded; European markets have been identified for this material. The developer is hoping to combine the recycling of plastics with the cooperation of the local councils, who have expressed an interest in this project. Glass will be crushed if needed, depending on the bulkiness of the material. Green Skip Ltd, propose to initiate a collection system for glass from the sources eg. hotels, restaurants etc. A market for this material has already been found by the developer. Ferrous metals will be collected and sold to local established scrap metal merchants. Non-ferrous metal (eg aluminium cans) will be compacted before selling to an identified outlet; it is envisaged that collection schemes can be provided at outlets selling products in aluminium containers (eg. soft drinks).

2.4.6 A compactor and shredder will be utilised to reduce the bulk of the waste to facilitate storage. These will typically have noise levels of 80dB(A) and 90dB(A) respectively (depending upon the specification of the equipment to

be used). A standby generator will be provided at the site to enable operations to continue in the event of a power failure or low voltage.

2.4.7 Green Skip Ltd. currently employs 6 full-time staff and 3 part-time staff; it is anticipated that as a result of the increased workload arising from this development, 10 to 12 full-time staff will be employed.

2.4.8 An independent company, Green Skip Rec. Ltd, is currently being formed to take over the operation of the above project. The directors will be Mary Gaerty and Doris Sammut who are currently also directors at Green Skip Ltd.

2.5 Environmental Disturbance

2.5.1 There will be a high standard of site operation at the Maghtab Sorting Yard and it will operate with the minimum of environmental disturbance. Stormwater will be collected and drained to the on-site wastewater settlement tank. Wastewater arising from the various site activities will be channelled into gullies and directed into the public sewer for treatment at a wastewater treatment plant. Details of the detergents to be used in the washing processes will be supplied once construction of the facility has commenced and will be subject to approval by the Drainage Department and the Health Department.

2.5.2 It will be necessary for the operator of the site to apply for, and obtain, a discharge consent prior to the release of any effluent to the sewerage system (under the Sewer Discharge Control Regulations 1993).

2.5.3 Noise will be sporadically generated by the operation of shredders and compactors and from the movement of vehicles at the site.

2.5.4 No organic waste will be transported to the site; odours from the waste will therefore not be produced.

2.5.5 It is likely that the new Public Waste Utility Site will attract additional users which will result in an increase in traffic visiting the site; these vehicles will be private passenger cars and small vans. The Waste Management section of EPD have identified that the development will not generate a significant increase in the number of vehicles that visit the site (pers. comms. June 1996). Members of the public already visit Maghtab to deposit bulky waste in the existing open skips. The development will not generate a significant increase in vehicles owned by Green Skip Ltd. visiting the site; these vehicles currently visit the adjacent landfill site on a regular basis to discharge their loads. The development of the Waste Reclamation Site would basically result in some of the vehicles being re-directed away from the landfill entrance and into the site.

# 3.0 OVERVIEW OF EXISTING ENVIRONMENT

## 3.0 OVERVIEW OF EXISTING ENVIRONMENT

### 3.1 Site Location

3.1.1 Maghtab is situated on the northern coast of Malta, some 5km north-west of Sliema (Grid Reference 775 495) (see Figure 3.1.1). The island of Malta, with an area of approximately 246km$^2$), is one of the three main islands forming the state of Malta.

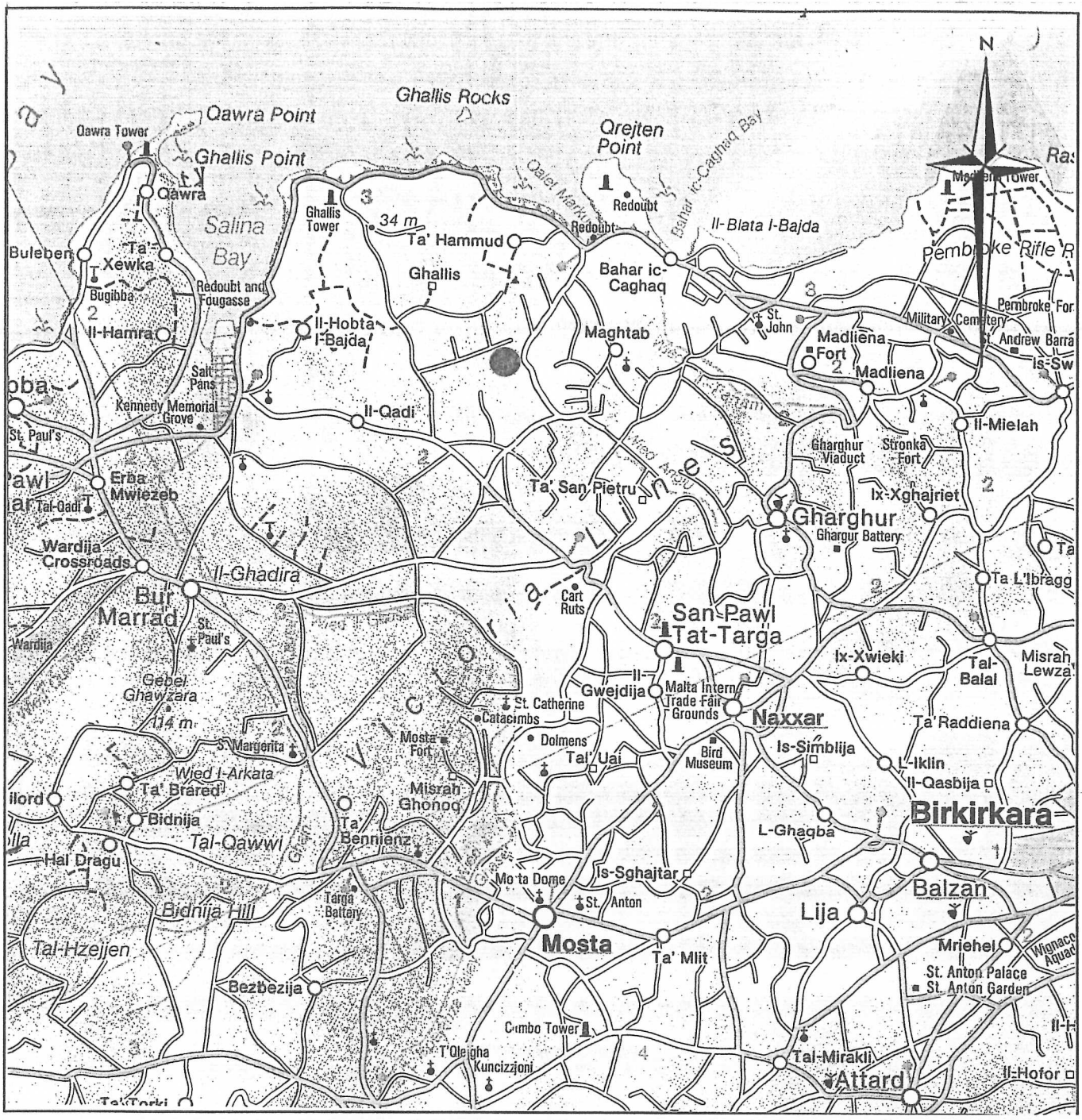
3.1.2 The proposed development site is located at the entrance to the Maghtab landfill. The area which currently houses a number of open skips is not to be developed by Green Skip Ltd. This area is owned by the Environment Protection Department and the skips are provided for the use of members of the public who need to dispose of small quantities of bulky waste.

### 3.2 Population and Surrounding Landuse

3.2.1 As of September 1992, the population of Malta was approximately 330,000. Valletta is the capital of Malta and is located on the north-east coast of the island. Other settlements of a significant size include Sliema, Birkirkara, Rabat, Hamrun and Qormi.

3.2.2 The industrial sector is Malta's largest producer; in 1990 it accounted for 66% of the total gross output, as compared with 8% for agriculture, 7% for construction activities and, 18% for the public utilities.

3.2.3 The proposed site lies within a relatively unpopulated area and is located immediately adjacent to the Maghtab landfill site.




Key

Site

ADVANCED INDUSTRIAL SYSTEMS

RUST Rust Environmental

# MAGHTAB SORTING YARD

## Site Location Plan

| | |
|---|---|
| Figure 3.1.1 | Scale : 1:38000 |
| Project No. EEMBL099 | Drawn By : N.L.G. |

## 3.3 Ecology

3.3.1 The Mediterranean region has a climate characterised by the alternation of a warm to quite hot, dry summer with a mild rainy winter. This type of climate allows the development of a vegetation biome which is described as sclerophyllous scrub. Such a vegetation type is commonly dominated by small trees or large shrubs with hard leaves, usually evergreen, and adapted to reduce water loss. Local geography and climate variations contribute towards making the Mediterranean plant life as rich and varied as in any part of the world.

3.3.2 Maquis is one of the commonest landscape types of the Mediterranean. It consists of bushes of about 1.5 to 2m in height and is encountered on slopes where the soil is too shallow to support forest development (primary maquis) or where the climax forest community has degenerated (secondary maquis). In the Maltese Islands, this community is dominated by such small trees and large shrubs as Carob *(Ceratonia siliqua)*, Olive *(Olea europea)*, Lentisk *(Pistacia lentiscus)* and occasionally Myrtle *(Myrtus communis)*.

3.3.3 In places where trees and shrubs have disappeared entirely, open communities called garigue are formed. In the Maltese Islands, garigue is found in places where the soil is too shallow for maquis or where the maquis has degenerated. Local garigues are dominated by small often hemispherical shrubs usually with small leaves. Plants growing in this habitat show much specialisation and a broad spectrum of species may be found in this community. This type of habitat is full of flowers in spring but presents a severely scorched aspect towards the late summer. Common plants include Mediterranean Thyme *(Thymus capitatus)*, Shrubby Kidneyvetch *(Anthyllis*

*hermanniae)*, Yellow Germander *(Teucrium flavum)* and Shrubby Germander *(Teucrium fruticans)*.

3.3.4 In addition to these vegetation types, the Maltese Islands support a steppe-like landscape characterised by a few grey-leaved shrubs and herbaceous plants, mainly grasses and tuberous biennials, scattered over the barren hillsides. In the Maltese Islands dominant grasses include the Steppe Grass *(Stipa capensis)*, Goat Grass *(Aegilops geniculata)* and Beargrasses such as *Hyparrhenia* hirta, and geophytes such as the Asphodel *(Asphodelus aestivus)* and the Seaside Squill, *(Urginea pancration)*.

3.3.5 Although the vegetation of the islands has been shaped by the prevailing climate, there is also an increasing pressure on the vegetation from human sources. As an archipelago of islands, there are several endemic plant species, some of which have become extinct as a direct result of mans activities eg. the Sicalo-Maltese endemic orchid, *Ophrys oxyrrhynchos.*

3.3.6 According to Chetcuti et al 1992, apart from consumption of the limited land resources for urban development, "the most serious environmental problem is the disposal of waste generated by the permanent and transient population and by industry".

3.3.7 The fact that there are great pressures on the Maltese ecology has been recognised by the government in its Structure Plan for the Maltese Islands (Draft Final Written Statement and Key Diagram 1990) (See Figure 3.3.1). This document contains several area designations affording different levels of protection to different types of site. Many of these designations have not yet been finalised so levels of protection afforded by them cannot be assessed.

# MAINLAND MALTA

N

WHITE TOWER AND ARMIER BAY
RAMLA BAY
CIRKEWWA
MARFA PENNINSULA
MELLIEHA BAY
ST. PAUL'S ISLANDS
ANCHOR BAY
MELLIEHA
BUGIBBA
QAWRA
SALINA BAY
ST. PAUL'S BAY
XEMXIJA
QALET MARKU
MANIKATA
BURMARRAD
BAHAR IC-CAGHAQ BAY
GHAJN TUFFIEHA BAY
ST GEORGE'S BAY
GNEJNA BAY
MGARR
ŻEBBIEH
PEMBROKE
PACEVILLE
GHARGHUR
ST JULIANS
NAXXAR
SLIEMA
FOMM IR-RIH BAY
MOSTA
MANDEL ISLAND
MARSAMXETT HARBOUR
TO SICILY
VICTORIA LINES
SAN GWANN
UNIVERSITY
GZIRA
GRAND HARBOUR
TA'QALI NATIONAL RECREATION CENTRE
LIJA
BALZAN
BIRKIRKARA
TAXBIEX
VALLETTA
FLORIANA
BAHRIJA
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RICASOLI INDUSTRIAL
SANTA VENERA
ATTARD
MRIEHEL INDUSTRIA
HAMRUN
SENGLEA
MDINA
MARSA
KORDIN AND DRYDOCK INDUST.
COSPICUA
RABAT
ŻEBBUĠ
ĦAĠAR
PAOLA
FGURA
ŻABBAR
DINGLI
MARSA INDUSTRIAL
TARXIEN
BULEBEL INDUSTRIAL
MARSASCALA
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DELIMARA POINT
FREEPORT
HAL FAR INDUSTRIAL
FILFLA

## Key

- Distribution road network
- Main passenger and vehicle ferry links
- Country parkways
- Marine conservation areas
- Existing built-up areas
- Existing industrial areas
- Rural conservation areas
- Areas of ecological value
- Areas of agricultural value
- (NP) National parks
- (A) Areas of archaeological importance
- (L) Light aircraft runway safeguarding area
- (TI) Priority tourism and recreation consolidation and improvement areas
- (T2) Priority areas for new tourism and recreation development
- (TR) Coastal zone areas for tourism and recreation restraint associated with designated offshore underwater marine parks

ADVANCED INDUSTRIAL SYSTEMS

RUST Rust Environmental

MAGHTAB SORTING YARD

Structure Plan Designation for Malta

| | |
|---|---|
| Figure 3.3.1 | Scale : N.T.S |
| Project No. EEMBL099 | Drawn By : N.L.G. |

3.3.8 The large majority of the site is covered by bare earth with intermittent piles of stone rubble and refuse, amongst which lie species tolerant to severe and regular disturbance. Vegetation is confined largely to the borders of the site and in amongst the piles of stone rubble present on the site. A detailed site survey was undertaken in January 1996 by Messers Stevens, Mifsud and Tabone. A copy of their report is attached as Appendix A.

3.4 Soils and Geology

3.4.1 The soils of the Maltese Islands have been studied by D.M. Lang (1960, Soils of Malta and Gozo). Maltese soils are characterised by their close similarity to the parent rock material, their relatively young age, the ineffectiveness of the climate in producing soil horizon development, and the great importance of human activities in modifying them. Using the Kubiena classification system, Maltese soils are of three main types:

- Terra Soils - relic soils; formed during the Pleistocene and little affected by the present climatic regime; mature and extensively weathered, low calcium carbonate content and also low in organic matter; developed on karstland.

- Xeroendzinas - immature, with a high calcium carbonate content and low in organic matter; develop on weathered Globigerina Limestone and on colluvial and alluvial valley deposits.

- Carbonate Raw Soils - immature, with a very high calcium carbonate content and very low in organic matter; develop on weathered Quaternary calcareous sandstones, on weathered Greensand and the lower beds of the Upper Coralline Limestone, on weathered

calcareous Blue Clay and on Globigerina Limestone alluvium and colluvium.

3.4.2 In addition there are soil complexes formed through human agency; either by mixing of powered rock with existing soil at the time terraces were cut, or by addition of rock debris to soil during reclamation of disused quarries, or by mixing domestic waste with soil for use in land reclamation, or by mixing of different soil types transported from different localities.

3.4.3 Geologically, the islands are composed almost entirely of marine sedimentary rocks, mainly limestones of Oligo-Miocene age. There are also some minor Quaternary deposits of terrestrial origin. The five main rock types are (in order of decreasing age):

- Lower Coralline Limestone - a dense, semi-crystalline, massive to well-bedded limestone, locally silicified, which is substantially a foraminiferal biomicrite or calacarenite. It is exposed to a thickness of 140m and palaeotological evidence suggests deposition in a shallow marine shoal environment at depths of less than 50m.

- Globigerina Limestone - a globigerinid biomicrite or calacarenite subdivided into three units (Lower, Middle and Upper Globigerina Limestones) by two phosphorite conglomerate beds known as the C1 and C2 horizons. It is exposed to a thickness ranging from 23m to 207m and the depositional environment was probably shelf waters at depths between 40 and 150m.

- Blue Clay - a local representation of the peri-Alpine "Schlier" facies of light and dark grey marls and capped by beds containing goethite

nodules. This stratum is exposed to a thickness of up to 65m and has probably been deposited in an open, muddy, marine environment at depths between 100 and 150m.

- Greensand - a glauconitic detrital limestone exposed to a maximum thickness of 12m.

- Upper Coraline Limestone - a varied group of carbonates, mainly algal, stromatolitic, biolistic and oolitic limestones, deposited in shallow water and exposed to a thickness of 162m.

3.4.4 Localised Quaternary deposits of Pleistocene age occur and comprise palaeosoils, fluvial gravels, alluvial fans, coastal conglomerates and breccias.

3.5 Hydrology and Water Resources

3.5.1 A hydrological appraisal of the site has been undertaken as part of this study and is incorporated as Appendix C. The islands' natural water resources depend entirely on rainwater percolating through the porous limestone rock and accumulating in aquifers from where it either seeps out or is pumped by man. It has been estimated that between 16 and 25 percent of the annual rainfall infiltrates to recharge the aquifers (Morris, 1952; Newbury, 1968; Chetcuti, 1988). The largest aquifer is the main sea-level aquifer which consists of a Ghyben-Herzburg lens of freshwater floating on denser saline water in limestone rock at sea level. The other aquifers of importance are perched aquifers, which consist of rainwater trapped in the permeable Upper Coralline Limestone due to the underlying layer of Blue Clay which acts as an aquiclude.

3.5.2 Water seepage from the perched aquifers occurs wherever the Upper Coralline Limestone/Blue Clay interface is exposed. This gives rise to so-called High Level Springs which drain into *widien* watercourses. Many of these springs used to flow all year round, albeit with much reduced flows in dry periods; however, most have now been tapped by farmers for irrigation purposes. A programme of small dam construction across the *widien* watercourses is aimed at reducing flow along these and retaining water in the *widien* for longer periods to allow increased infiltration and to supply water for irrigation.

3.5.3 Water production from desalination plants accounts for a substantial proportion of the first class water produced. (Source: Annual Report, 1994, Water Services Corporation).

Surface Hydrology

3.5.4 The site lies at the centre of the surface catchment area which comprises the shallow valley bordered by the Ta' Hammud plateau to the north, the village of Maghtab to the south and south-east, and the coast to the north. The watershed of the valley runs to within 750 metres north of Wied il-Ghasel Pumping Station. There are no natural springs within the confines of the catchment area.

3.5.5 Water only flows along the bed of the valley for a few days after heavy downpours. Given the low gradient of the catchment area, the hydrological response of the catchment area following a storm event is believed to be rather slow. Rubble walls bordering the fields in the valley limit the amount of runoff reaching the sea and soil erosion.

3.5.6 The amount of runoff generated within the Maghtab Dump, the eastern half of which lies within the catchment area described above, is considerable. This is apparent by the amount of silt which covers the road leading from the Maghtab Dump to the coast at Qalet Marku Bay. The hydrological response of the dump following a rainfall event is rapid, arising from the fact that the dump is situated on sloping terrain. Given that a large proportion of the Maghtab Dump consists of construction rubble with large aggregates, the water retention capacity of the Dump is believed to be somewhat limited. Carry-over of fine construction material (silt) from the dump to the sea is therefore considerable. Although the carry-over of silt and uncovered waste takes place along the whole periphery of the Maghtab Dump, runoff from the southern part of the Maghtab Dump is particularly high due to combined effects of the relief of the bedrock at the dump and the steep sides of the dump itself. Runoff from this part of the dump flows into the valley basin and along the road described above, eventually reaching the sea at the bay at Qalet Marku.

3.5.7 Contaminated runoff from the Maghtab Dump may be reaching the cultivated fields in the valley and polluting the soil in the valley and the crops growing therein. This can only be confirmed through the undertaking of a sampling exercise during periods of high rainfall. There exists also the possibility that part of this runoff is being channelled into small storage reservoirs for use as supplementary irrigation during dry periods. This could however not be confirmed during this study and is beyond the scope of this EPS.

Groundwater

3.5.8 The groundwater system which lies beneath the site in question forms part of the Mean Sea Level (MSL) Aquifer of Malta. The Mean Sea Level

Aquifer is the most important aquifer in the Maltese Islands and at present accounts for about 90% of the total groundwater extraction for the public supply. This aquifer extends from the Pwales valley in the north onto the southern and eastern coast of Malta.

3.5.9 This aquifer lies in the pores and cracks of the Globigerina and Lower Coralline Limestone situated in the region of the mean sea level. This freshwater body owes its existence to the fact that every winter the local rainfall adds more freshwater to the underground store than can be dissipated by direct discharge around the coast. There is no sharply defined plane of separation between the superficial freshwater and the saline water which is underneath as the two water bodies are separated by a 'mixing zone' of brackish water.

3.5.10 The equilibrium of the aquifer is in a state of flux depending on the fluctuations in rainfall, and to a lesser degree, on the tidal effect. Increasing exploitation of this aquifer, especially during the last 25 years, has resulted in the upcoming of salt water at the site of extraction and a general lowering in the height of the freshwater lens coupled with a deterioration in water quality. The height of the water table varies substantially within the range 1.5 to 3.5 metres above mean sea level under static conditions for different but neighbouring areas in the central part of the island. It decreases gradually to mean sea level at the coast.

3.5.11 Recharge to the aquifer is predominantly through fissures in the overlying Globigerina Limestone and the Lower Coralline Limestone (where exposed). Porosity and permeability is mostly fissure dependent (secondary permeability) and therefore these aquifer properties assume a wide spectrum of values for different areas in Malta.

3.5.12 Extraction from the aquifer is made through a system of underground galleries situated near the central axis of the island and also by boreholes which are positioned further away from the centre. A number of private boreholes also extract water for irrigation.

3.5.13 The MSL Aquifer of Malta is highly karstic in nature. This implies that the flow direction and velocity of groundwater flow in the unsaturated and saturated zones of the aquifer are very difficult to determine and assess. In other words, whilst the general flow direction (as determined from piezometric flow levels) may be from the centre of the island towards the coast, underground water channels may be transporting water in the opposite direction. This is of particular concern when one considers the motion of contaminants in the groundwater. Due to the inherent heterogeneity of the aquifer, contaminants leaching from potential polluting sources (such as landfills) located outside the 'Groundwater Protection Zone' i.e. near the coast for example, could effectively be moving inwards towards the centre of the island and reaching pumping stations and boreholes which extract water for human consumption.

Groundwater Extraction at the Site

3.5.14 There are a number of private ground water extraction boreholes in the near vicinity of the site. The extracted groundwater is diluted with rainwater (when available) and used for irrigation. A single windmill is present in the valley area but is not believed to be in an operational condition.

3.5.15 Water for the public supply is extracted from the same aquifer at Wied il-Ghasel Pumping Station located at a distance of approximately 1.25km to the south of the proposed site. The salinity of the water extracted at this

pumping station is known to be relatively high (in the 2000 mg/*l* chloride bracket). A number of public boreholes in the Naxxar-Gharghur area also extract groundwater for the public supply but these are believed to be outside the sphere of influence of any contamination arising from the waste site.

Ground Water Quality

3.5.16 An investigation into the quality of the groundwater in the vicinity of the site has been undertaken and is incorporated as Appendix B to this EPS. Groundwater samples were collected from a private borehole located approximately 40 metres to the east of the eastern limit of the site. The borehole depth was estimated to be 20 metres, or approximately at the mean sea level. The water was analysed for salinity content, pH, dissolved oxygen and basic chemical parameters.

3.5.17 The water quality of the ground water at the site was found to be of very poor quality with the water having a high salt content (brackish water). The high salinity value limits the possible use of the groundwater to irrigation only, and this only when diluted with rainwater. Regular irrigation of the soil with the groundwater will affect greatly the soil alkalinity and salinity. The groundwater is certainly unfit for potable use since most of the chemical parameters examined greatly exceed the permissible limits. These parameters include specific conductivity, hardness, chlorides, nitrates and nitrites.

3.5.18 A high value for nitrate was registered. This value, corresponding with a relative low value for nitrites and ammonium indicate that the groundwater is oxygen-saturated. This is confirmed by the high dissolved oxygen level. The source of the high nitrate content (which when corrected for sea water intrusion represents a concentration of 85.5mg/*l*) is believed to be the

spreading of liquid waste on fields at the adjacent pig farms. The high nutrient content in the waters of ponds lying in close proximity to the farms indicate the possible carry-over of nutrients from the slurry ponds to these rainwater ponds.

3.5.19 The commercial value of the groundwater in the area is therefore considered to be negligible.

## 3.6 Climate and Air Quality

3.6.1 Climate is composed of many different meteorological factors including precipitation, temperature, wind speed and direction, relative humidity, hours of sunshine and constancy of meteorological factors, such as the frequency of storms. The main meteorological vectors of concern here are precipitation, temperature and wind.

3.6.2 The climatic data cited in this report have been taken from The Climate of the Maltese Islands: A Review; D.Chetuti et al and are therefore general data for the whole of the archipelago rather than specifically for the island of Malta. However, due to the size of the islands there is not likely to be a significant difference between the islands and the data provided here will be relevant to Malta and therefore to this study.

### Precipitation

3.6.3 The average annual rainfall for the islands, averaged over 133 years, is estimated to be 530mm (Standard Deviation 153mm). The rainfall is, however, highly variable between years and has varied between 1031mm and 191mm over this time period. The occurrence of very wet or very dry years

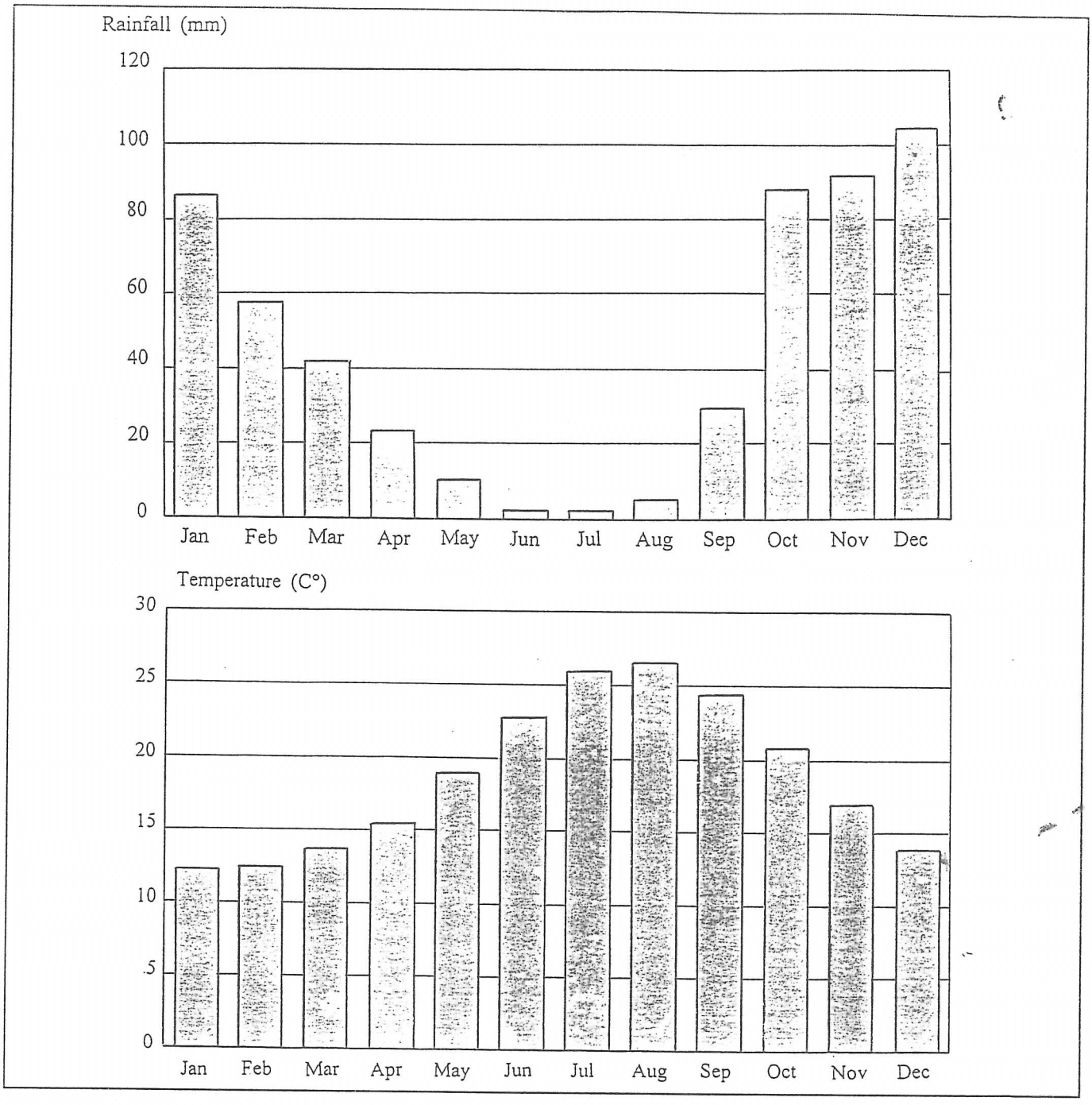
does not appear to follow any specific cycle, although often after a very wet year, below average rainfall will occur.

3.6.4 In general, the majority of precipitation falls in winter between the months of October and March with the highest mean rainfall occurring in December. Some 85% of the total annual precipitation falls during this six month period. The driest month is July with an absolute drought being recorded in 115 out of 133 Julys between 1854 and 1986. Figure 3.6.1 indicates mean monthly rainfall for this period. The rainfall related figures indicate average precipitation across all of the Maltese Islands.

Temperature

3.6.5 The mean air temperatures recorded in the Maltese Islands on a monthly basis do not show massive fluctuations. The mean monthly temperature varies from 12.3°C to 26.3°C, the hottest months being July and August, the coldest being January and February. These data are illustrated on Figure 3.6.1.

3.6.6 The mean monthly temperatures are based on the mean temperature recorded during each day in every month. However, another good indicator of the average air temperatures of the islands is to calculate the mean of the maximum temperatures recorded each day. For August this shows that, although the mean monthly temperature is 26.3°C, the mean daily maximum is 30.6°C. Similarly for January, although the mean monthly temperature is 12.3°C, the mean daily minimum is 9.2°C. These figures give a clearer indication of the variability of temperature on the islands.




Mean monthly rainfall in millimetres for the period 1854-1986. Based on data obtained from the Water Works Department (1854-1950) and the Luqa Meteorological Office (1951-1986).

Mean monthly air temperature for the period 1951-1986. Based on data obtained from the Luqa Meterological Office.

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Mean Monthly Rainfall & Temperature

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|---|---|
| Figure 3.6.1 | Scale : N.T.S |
| Project No. EEMBL099 | Drawn By : N.L.G. |

Wind

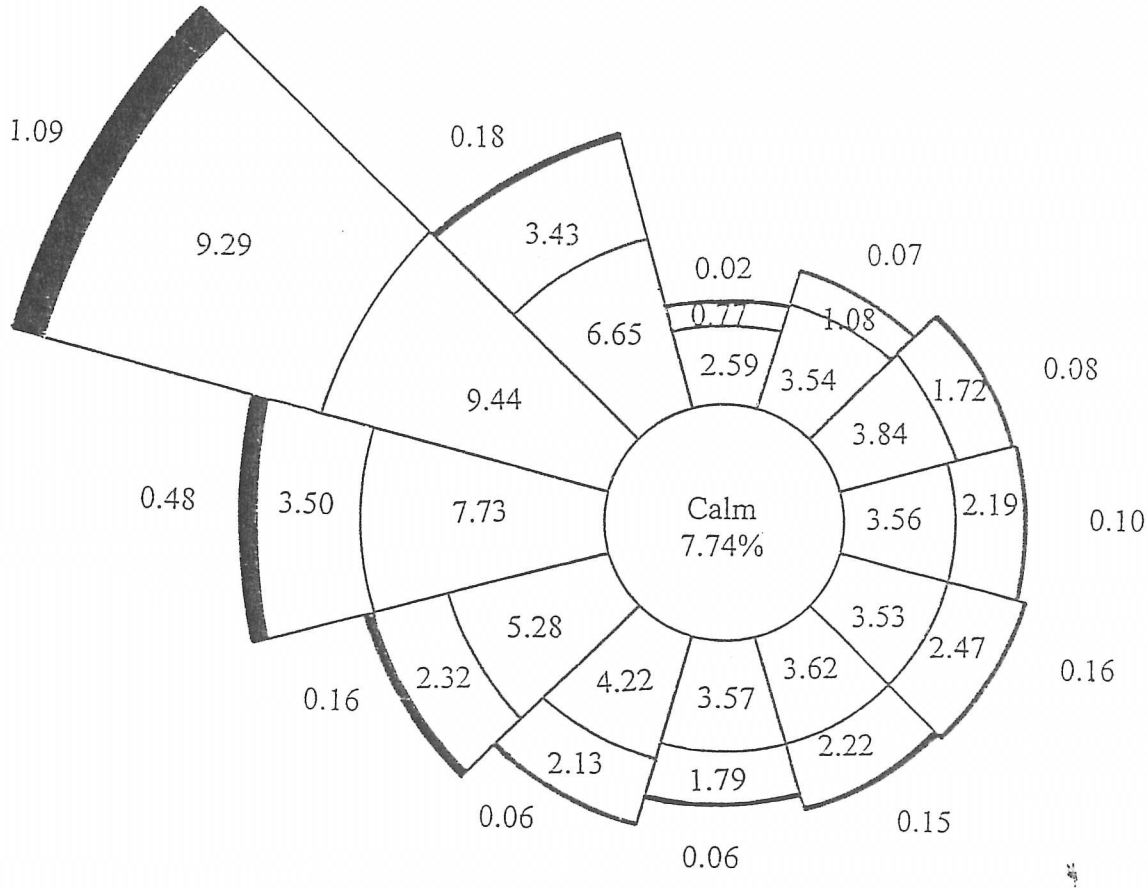
3.6.7 The Maltese Islands are generally considered to be windy. The prevailing wind (the Majjistral) blows to the north west throughout the year, blowing approximately 19% of time. Another wind (called the Punent) also blows regularly, but to the north, north-west and west. An annual wind rose for the region is presented on Figure 3.6.2.

3.6.8 The wind speeds encountered alter between months. December is the windiest month with an average of 6-7 days on which winds of over 63km/hr are recorded (based on data from 1951-1980). The months of January, February and March each have approximately 5 days of gale force (over 63km/hr), June, July, August and September all experience, on average, less than one day of gale force winds.

3.6.9 There have been various storm incidents in the Maltese Islands, which have generally caused much damage. A storm in this context is defined as a violent disturbance of the atmosphere with high winds and frequent thunder, heavy rain, hail, snow etc. or strong wind. Documented major storms appear mainly to occur in the months of October, November and December caused by cold northerly air coming into contact with warm air lying over the Mediterranean Sea.

Air Quality

3.6.10 It is very difficult to quantify or describe air quality in an area without access to existing air quality data or without undertaking an extensive monitoring programme. No air quality data for this area of Malta was available for this study. However, in general, a reduction in air quality

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MAGHTAB SORTING YARD

Annual Wind Rose

| Figure 3.6.2 | Scale : N.T.S |
|---|---|
| Project No. EEMBL099 | Drawn By : N.L.G. |

occurs when wind speeds are low, usually in a period of high pressure, but particularly when air pressures are fairly constant (air will flow, as a wind from an area of high pressure to low pressure thus transporting and dispersing pollutants). These weather conditions generally occur in the months of June to September which are therefore the months when the islands have the greatest potential to suffer from poor air quality.

3.6.11 Air quality may be impacted upon by a number of different factors, namely industry and vehicle emissions. There are a number of factories to the west and south-west of Maghtab although they are not concentrated together on an industrial estate. Existing traffic resulting from the operation of the landfill at Maghtab and odours arising from the landfill and nearby farms are likely to cause a reduction in local air quality.

## 3.7 Landscape

3.7.1 Erosion of the different rock types gives the Maltese islands a characteristic topography. Lower Coralline Limestone forms sheer cliffs which bound the Maltese islands to the west; inland this rock type forms barren grey limestone-pavement plateaux on which karstland develops. Globigerina Limestone, which is extensively exposed, forms a broad, rolling landscape. Blue Clay slumps out from exposed rock faces to form taluses at 45° over the underlying rock. Upper Coralline Limestone forms massive cliffs and limestone pavements with karstic topography similar to the Lower Coralline Limestone.

3.7.2 There are no mountains on Malta; the highest point on Malta is near Ta 'Zuta (253m) on Dingli Cliffs (SW Malta). There are no lakes, rivers or

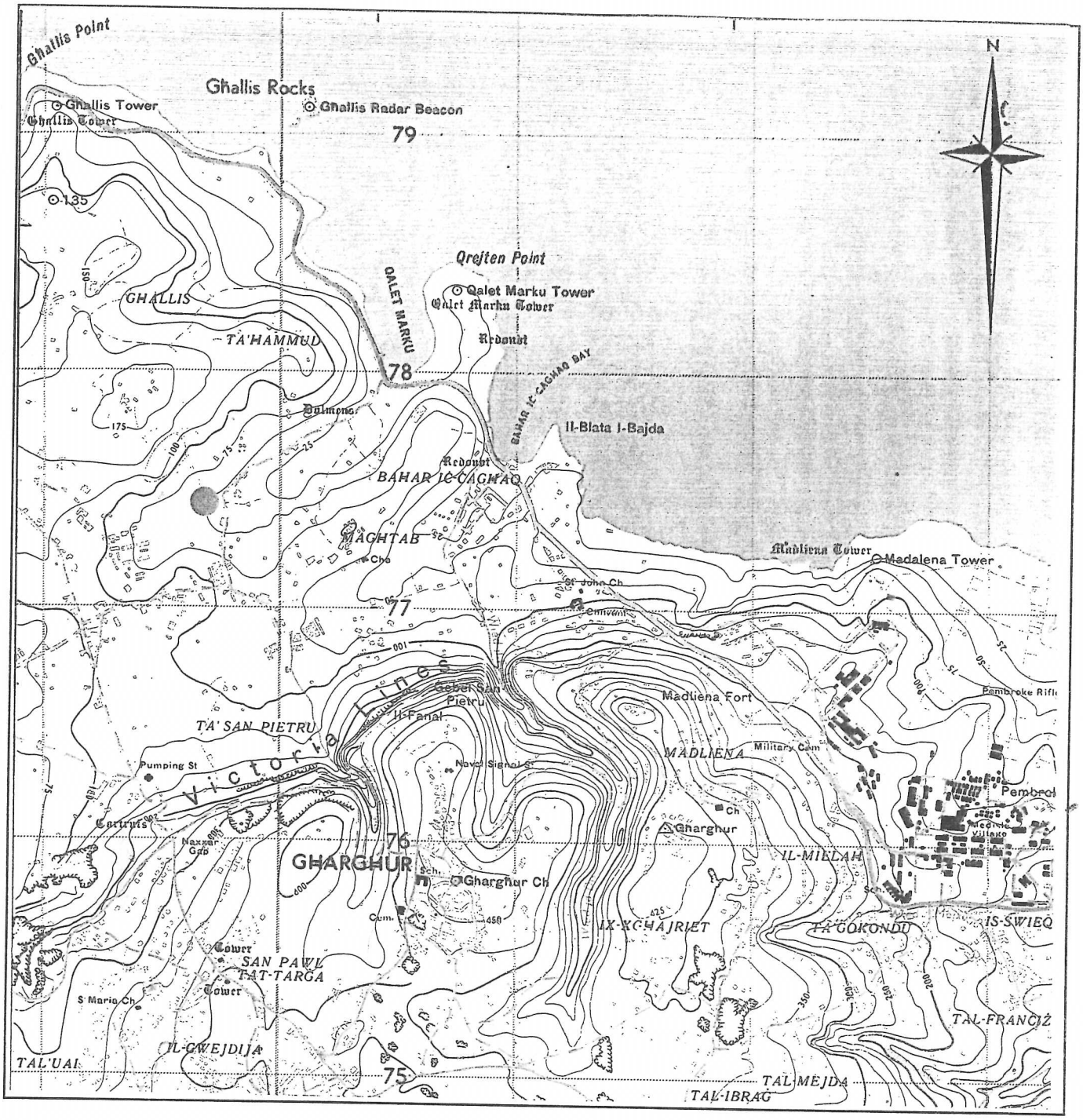
streams but there are minor springs. A topographical map of the area is illustrated in Figure 3.7.1.

3.7.3 Characteristic topographic features are the *rdum* and *widien* (singular *wied*). *Rdum* are near vertical faces of rock formed either by erosion or by tectonic movements. Their bases are invariably surrounded by screes of boulders eroded from the *rdum* edges. *Widien* are drainage channels formed either by stream erosion during a previous much wetter climatic regime, or by tectonism, or by a combination of the two processes. Most *widien* are now dry valleys, that is, they only carry water along their watercourses during the wet season; a few *widien* drain perennial springs and have some water flowing through them throughout the year, attaining the character of miniature river valleys.

3.7.4 Changes in sea level have submerged the mouths of some of these *widien* where they exit on the coast, giving rise to headlands, creeks and bays. This is especially evident on the NE coasts because of the island's seawards tilt in this direction. Especially important are the systems of drowned valleys which form the creeks of Malta's two main harbours, Marsamxett Harbour and Grand Harbour, separated by the Valletta headland.

3.7.5 The proposed site is located to the north of Victoria Lines (the Great Fault) in a relatively low-lying area between the escarpment, caused by the Great Fault, and the coast.

3.7.6 The existing site is currently visually unappealing with large quantities of stone rubble and other wastes piled around the site; this is clearly visible from surrounding properties and the road adjacent to the site.




Key

Site

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# MAGHTAB SORTING YARD

## Topographical Map

| | |
|---|---|
| Figure 3.7.1 | Scale : 1:25000 |
| Project No. EEMBL099 | Drawn By : N.L.G. |

## 3.8 Archaeology

3.8.1 The archaeological potential of the area in and around the proposed site has been investigated by the Museums Department, National museum of Archaeology, Valletta, and the findings made available (see Figure 3.8.1). Additional information has been supplied by the Environmental Management Unit (EMU).

In the near vicinity to the site a number of archaeological features have been identified. These are presented in Table 3.1.

**Table 3.1 Archaeological features in the vicinity of Maghtab**

| Site | Co-ordinates | Distance & Bearing from Maghtab Tombs |
|---|---|---|
| Tal-Qadi Temples | 4775 E/7725 N | 1.8km due west |
| Qaliet Marku Megalithic Remains | 4990 E/7760 N | 0.35km due east |
| Ta' Hammud Dolmens | 5025 E/7780 N | 0.70km due north-east |
| T'Alla w Ommu cart ruts | 4940 E/7500 N | 1.5km due south |
| Salina Catacombs | 4820 E/7808 N | 1.4km due west |
| Maghtab 'covered way' | | |
| Maghtab tombs & ancient quarry | 4960 E/7750 N | |

This information was supplied by the EMU

3.8.2 The area directly affected by the proposed development is currently being used as a parking area for refuse tipping containers and vehicles. The parking area has been levelled out and, consequently, the original natural


Key

Site

Maghtab Tombs

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MAGHTAB SORTING YARD

Archaeological Features

| | |
|---|---|
| Figure 3.8.1 | Scale : N.T.S |
| Project No. EEMBL099 | Drawn By : N.L.G. |

aspect and the lie of the land has been extensively damaged. It is therefore almost certain that the area identified for the present development does not have any significant archaeological potential.

3.8.3 It has been identified that there are clusters of Paleochristian hypogea cut in the vertical face of an ancient quarry in the vicinity of the proposed site; these features have not been the subject of careful study. The Museums Department is currently preparing a 'management plan' for this particular archaeological monument in the context of a much broader management plan for the cultural resources of Naxxar Local Council.

3.8.4 The importance of the tombs is that these form a substantial cluster whose potential might be similar to those at Salina Bay. Their extent and characteristics cannot be assessed properly due to the refuse covering them.

3.8.5 At present, the tombs are visually unappealing, surrounded by litter, larger items of waste and uncontrolled vegetation. It is understood that the management plan will recommend that the appearance of the Maghtab Tomb Cluster be improved in order to encourage its promotion.

3.8.6 The archaeological significance of the ancient quarry is also of note since no detailed study has yet been attempted on this subject, and until now no-one can exactly determine their value. Both the tombs and the ancient quarry merit at least a Grade B protection with a minimum 20m buffer zone from the limits of the site.

3.9 Local and National Planing Policies

3.9.1 The following documents have been consulted during the preparation of this Environmental Planing Statement.

- Structure Plan for the Maltese Islands - Draft Final Written Statement and Key Diagram: December 1990, Ministry for Development of Infrastructure (Planning Services Division).

- Structure Plan for the Maltese Islands - Explanatory Memorandum: December 1990, Ministry for Development of Infrastructure (Planning Services Division).

- Structure Plan for the Maltese Islands - Summary of Public Consultation: January 1991, Ministry for the Development of Infrastructure (Planning Services Division).

- METAP: Solid Waste Management Strategy, The Republic of Malta, February 1993: RH and H Consult, Denmark.

- Environmental Protection Act, 1991.

- Malta National Waste Study, Interim Report, July 1992.

3.9.2 The Draft Final Written Statement acknowledges that the generation and disposal of waste is a major concern, and is an issue requiring a complete change of policies, procedures and altitudes.

3.9.3 Policy PUT 15 of the Structure Plan for the Maltese islands states that *"An adequate number of controlled centres will be provided for use by the public for the deposit of refuse. Separate containers/skips will be included to facilitate waste recycling.* The proposed Sorting Yard at Maghtab will go some way towards providing the number of 'controlled centres' required and will encourage and facilitate waste recycling with the provision of separate skips.

3.9.4 The Solid Waste Management Strategy (METAP) discusses the overall strategy for Solid Waste Management. The strategy is based on the European Communities 'ladder' of preferred options. The first priority is the prevention of waste production; the second priority is to increase the amount of sorting and recycling of solid wastes. This development is therefore in line with this strategy.

# 4.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS AND OUTLINE OF MITIGATION MEASURES

## 4.1 Air Quality Impacts

4.1.1 The existing air quality in the vicinity of the proposed Maghtab Sorting Yard will fluctuate widely depending on weather conditions. The dispersion of odour emanating from the adjacent Maghtab landfill will also vary depending on air temperature, wind speed and direction.

4.1.2 Impacts on air quality have the potential to occur during the construction phase and the operation of the facility. These are considered in turn.

### Construction Impacts

4.1.3 During the construction of the Sorting Yard (which will take approximately 3 months) some dust generation may occur. This impact will be restricted to dust emissions during the ground preparation/levelling phase. Residential areas are not located nearby and will not be impacted upon by this activity. There is a slight possibility that the photosynthetic abilities of the surrounding vegetation may be affected through direct dust settlement on leaves. However, the scale of this impact will be negligible compared with the levels of dust currently produced as a result of the operation of the adjacent Maghtab landfill.

4.1.4 Impacts on air quality from vehicle and plant emissions will be negligible due to the very small number of plant that will be required during the short construction period.

Operational Impacts

4.1.5 During the operation of the Maghtab Sorting Yard, dust generation will be minimised through a number of measures. The site will be surfaced with concrete where materials storage will take place or tarmacadam in car parking areas. This will allow the carriage of heavy vehicles and facilitate the control of stormwater and foul water. The hard surfacing will therefore significantly reduce fugitive dust emissions from vehicles using the facility.

4.1.6 It is not anticipated that there will be any odorous emissions to air associated with the processes taking place at the facility. As organic waste will not be taken to the facility the odour problems associated with this type of waste will not arise; Green Skips Services Ltd only carry dry and inorganic waste, mainly from industrial sources. It should be noted that, in contrast, significant odours are produced from the adjacent landfill facility.

4.1.7 It is likely that the development of the facility will attract additional users and will therefore result in an increase in the number of private passenger cars and small vans visiting the site. However, in view of the fact that a significant number of large vehicles (lorries, refuse collection vehicles, etc) visit the adjacent landfill every day, the associated increase in traffic will be insignificant; any impact on air quality arising from this increase will be negligible.

4.1.8 Litter blow will be minimised through working practices and regular collection of fugitive and occasional escapes of materials susceptible to pick up by wind etc.

## 4.2 Water Quality and Effluent Disposal

4.2.1 Impacts on water quality in the vicinity of the proposed development may occur either during the construction stage or subsequently during the operation of the facility.

### Construction Phase Impacts

4.2.2 The use of construction vehicles can sometimes result in localised oil or fuel spillages and sediment run off. The risk of such spillages at the proposed site is considered to be minimal in view of the limited amount of construction to be undertaken, the short construction period and the small number of vehicles operating on the site. The risk of contamination of groundwater is therefore considered to be very low.

### Operational Impacts

4.2.3 During the operation of the facility there are two aspects relating to water disposal to be considered; firstly, surface water (or stormwater) disposal, and the disposal of effluents produced as a by-product of the facility operation.

4.2.4 Rainfall run-off from all roof areas within the facility will be discharged via guttering and associated pipes and will therefore not come into contact with either waste or vehicles and will not be contaminated. In view of the low rainfall on Malta and the relative shortage of water, it is proposed that water falling on the roof areas should be collected, stored and used for washing and landscaping purposes. An underground reservoir will be constructed for the purpose of storing water from run-off and other sources. A simple filtration

system will enable water to be recycled and re-used. It is envisaged that approximately 4600m$^3$ of rainfall can be collected from the site during a one year period.

4.2.5 Surface water from the areas of hardstanding will be directed to the site surface water drainage system and into the underground reservoir (see Figure 3.1.1). This drainage system will incorporate oil and grit interceptors to remove spilt oil and other solids resulting from the activities at the site. Rainfall run-off will only be an issue during the rainy season (October to January) and the system will be designed to cope with such flows.

4.2.6 Waste water arising from the toilet and shower block located in the office complex will be directed to a cess pit. Discharge of effluent to the sewerage system will be carried out under licence from the Drainage Department (Sewer Discharge Control Regulations 1993).

4.2.7 Impacts upon water quality and the foul sewer system from the operation of the Sorting Yard are considered to be minimal in view of the following:

- Surface water will be collected where possible and reused thus minimising the volume of water diverted to the sewerage system;
- The presence of an oil and sediment interceptor;
- Foul effluents will be directed to the sewer for disposal and kept separate from stormwater;
- No hazardous or municipal wastes will be handled by the site

- Water resulting from washing processes will be directed to the underground reservoir for recycling and re-use;

- The amount of land to be incorporated in the proposed development is negligible when compared to the size of the Maghtab Dump;

- The amount of material to be excavated from the site during the construction of the sorting yard is negligible when compared to the amount of construction rubble at the Maghtab Dump. The necessary precautions will have to be taken to ensure that there will be no addition carry-over of excavated material onto the fields downstream of the site;

- Leachate (if any) arising from the waste will be channelled to gullies and either treated in-situ or channelled into the public sewer for treatment at the public wastewater treatment plants. Dumping and sorting of industrial waste on open ground (as is happening today) will not be undertaken.

- No leachate will be disposed of to the ground or surface water.

- A perimeter wall will be built to prevent the spreading of wastes from sorting yard to surrounding areas by the action of wind and vermin.

4.2.8 It can therefore be concluded that construction of an industrial waste sorting yard at the proposed location will have an overall beneficial effect on the immediate and surrounding areas. The hydrological benefits include:

- the prevention of the dumping of industrial waste on open ground and therefore the leaching of pollutants into the groundwater table;

- the prevention of the generation of waste-contaminated run off from the site which eventually reaches the cultivated fields downstream of the site. Silt carry-over from the site will be less than this once the hardstanding and interceptor drains have been constructed;

- the collection, storage and re-use of the rainwater collected at the depot for the growing and watering of trees for landscaping of the sorting yard itself and the surrounding area and for washing purposes provides the added benefits of soil stabilisation and reduction in soil erosion; and

- the collection, sorting and exportation of industrial waste provides for general amelioration of groundwater and surface water quality.

4.3 Ecological Impacts

4.3.1 In view of the fact that the area for development is already severely disturbed, the ecological consequences of the proposed development will very limited. The possible effects of the development on areas adjacent to the site will therefore be emphasised. These could fall in two categories:

- Impacts arising during construction
- Impacts resulting from the operation of the facility.

Impacts arising during the construction phase

4.3.2 During the construction phase the principal source of disturbance is most likely to be uncontrolled runoff from the site flowing into adjoining areas. Runoff may contain soluble materials derived from construction materials and fuel oils derived from fuel spillages; this will be minimised by as much as possible to avoid impacts on adjacent ecology.

4.3.3 In order to minimise the potential input of hydrocarbon into the groundwater or local surface water is recommended that overnight parking of heavy plant should ideally be on an area of hardstanding with provision for drainage into a sump or the local sewer (via an interceptor). In addition, there should be no storage of fuel oils or refuelling of vehicles on site. Runoff from the site should be controlled during the construction phase; ideally this could be achieved by avoiding the winter months for construction.

4.3.4 It should be remembered that carry-over of silty construction materials from the existing landfill following rainfall is quite considerable. It is therefore recommended that, as far as possible, any waste construction material requiring disposal should be disposed of at the adjacent Maghtab landfill. Any additional material resulting from the relatively small-scale construction process at the sorting yard is likely to be insignificant.

4.3.5 The survey of the site conducted in January 1996 (see Appendix A) concluded that once completed the development is not expected to have a direct impact on the ecology of the nearby sites, provided that development is restricted to the proposed site boundaries.

Impacts resulting from the operation of the facility

4.3.6 Operation of the sorting yard will result in the periodic production of effluents (see Section 4.2). It should be ensured that no effluent capable of impacting upon any sensitive species is discharged from the site. This will be achieved through the incorporation of a system of drains and gullies which will direct runoff, wash water and other discharges into the appropriate collection system.

4.3.7 The earth berm to be constructed around the boundary wall will be planted with indigenous plant species. Details of these have been supplied by the Planning Department and included as Appendix D of this document. It is recommended that the construction of the boundary wall and earth berm takes place early in the construction period and planted as soon as possible thereafter. Plant species selected for landscaping should be subject to the following requirements:

- They should be indigenous to the Maltese Islands. This reduces the extent of proliferation and invasion of adjacent communities.
- They should be drought-tolerant and require minimal maintenance.

4.3.8 The inclusion of perimeter planting and landscaping of areas within the development area (see Figure 2.1.1) will improve the aesthetic appearance of the sorting yard. Management of the planted areas will be essential to preserve the visual quality of the site. A landscaping plan and management proposals for the facility will be drawn up once final design has been

completed. This will be submitted to The Planning and Environmental Protection Departments for comment.

4.3.9 A number of other mitigation measures have been suggested as part of the ecological survey. These are:

- the mixed garigue and steppe supporting the rock pools is protected as much as possible from the nearby development, and that **no dumping of any type** (including building material) should be thrown or placed in this area; and outside of the construction boundaries both during the construction and operating phases.

- the mixed garigue and steppe is fenced to safeguard better the rock pools and allow the regeneration of the natural vegetation of the area;

- during both the construction and operating phases, the sorting plant should keep to the building areas and that they also keep to the designated access roads.

- only native and archaeophytic trees are planted and that monocultures are avoided.

- trees are planted only in the disturbed areas indicated on the map next page, and that no trees should be planted in the mixed garigue and steppe area.

- no dumping of any type should be placed in the nearby agricultural land both during the construction and operation phases.

## 4.4 Visual Impacts

4.4.1 The main visual elements of the development that have the potential to create visual impacts will be:

- the garage;
- the office and amenities block;
- the open-walled sheds for the storage of paper and cardboard (made of reinforced concrete and covered with corrugated steel sheets and stone coloured); and
- the perimeter wall.

The above elements have the potential to cause visual impact because they will introduce vertical elements into a currently flat area of land.

4.4.2 Due to the topography, the proposed site will be visible from the areas of higher ground to the south and south-east. A variety of properties are located on these areas of higher ground at Gharghur, Gebel San Pietru, Il Fanal and other areas on and around the slopes at Victoria Lines. However, the potential impact of the proposed site will be reduced because of the following:

- the distances between the proposed site and the vantage points to the south; and

- the presence of a variety of existing buildings (residential and industrial) scattered in the vicinity of the site and in the area between the site and the Victoria Lines;

- the presence of the adjacent Maghtab Landfill, a major visual element in the area; and

- the poor visual appearance of the existing facility.

4.4.3 The existing site is also visible from a number of surrounding properties and the Maghtab Tombs which are immediately north of the site. The poor appearance of the area currently renders the site visually intrusive. It is therefore considered that the improvements planned as part of this development will enhance the area visually.

4.4.4 A perimeter wall will be constructed around the site to a height of 3 metres against which will be constructed an earth berm approximately 1.5 metres high. The earth berm will be planted with indigenous plant species which will therefore significantly 'soften' the effect of the perimeter wall. The wall will also serve to screen the activities and much of the associated building and plant from low-lying properties and viewpoints. Building materials will be selected in terms of colour and texture to blend with the local building characteristics and are illustrated on Figure 2.1.2.

4.4.5 It is considered that the improvement in the visual environment will be as a result of:

- the provision of a tidy, planted site boundary, a surfaced ground area and a high standard of site operation;

- a decrease in the current amount of fly-tipping and other uncontrolled waste disposal activities.

## 4.5 Traffic Impacts

4.5.1 In order to assess impacts from traffic it is necessary to identify the vehicles visiting the site. These can be categorized under three distinct headings:

a) Waste collecting vehicles operated by the Green Skip Ltd
b) Public vehicles consisting of private passenger cars and small vans.
c) Passenger cars owned by employees and visitors.

4.5.2 The development of the proposed Sorting Yard at Maghtab would not result in an increase in the number of vehicles using the public roads leading to the site. At present, these vehicles already use the public roads to visit the adjacent landfill site on a regular basis to discharge their loads. The development of the Sorting Yard would result in some of the vehicles being re-directed away from the landfill entrance and into the proposed site.

4.5.3 The Maghtab Landfill, presently allows for the discharge of waste brought by the general public, usually in passenger cars and small vans. The setting up of the proposed Sorting Yard may attract some of these visitors to unload their waste at this site. The Environmental Protection Department has a policy to encourage the public to recycle materials. Whilst the opening of the Sorting Yard might make more people aware of the recycling of waste, it is not anticipated that just by providing this facility, the general public would start depositing their waste at this site. The general public would still depend heavily on the services offered, free of charge, by the Environmental Protection Dept.

4.5.4 Presently, the general public may already visit Maghtab landfill to discharge waste (normally bulky waste). It is not envisaged that the opening of the proposed Sorting Yard would significantly increase the present number of this type of visitors. Green Skip Ltd currently employs 6 full time staff and 3 part time staff. It is anticipated that as a result of the increased workload arising from this development, 10 to 12 full time staff will be employed.

4.5.5 The nature of this development does not normally attract a large number of visitors. Typical visitors to this site would normally be service and maintenance personnel and the occasional customer and salesperson.

4.5.6 Parking arrangements for these vehicles is to be allowed for within the premises.

4.5.7 The increase in traffic arising from these vehicles would have a negligible impact on the public roads. A heavy load of traffic already visits daily the adjacent Maghtab landfill. The addition of an estimated maximum 10 to 15 passenger cars bringing in employees with occasional visitors arriving/leaving during nominal business hours would have a negligible impact on the existing public road network.

4.6 Archaeological Impacts

4.6.1 The main concerns of the Museums Department regarding the effects of the proposed development on the monument (Maghtab Tomb Clusters) are as follows:

- the public right of access to the archaeological site;

- the visual impact of the development when viewed from the monument;
- the effect of emissions of noxious or offensive odours from the development; and
- the effect of noise generated from the industrial plant.

4.6.2 Careful attention must also be paid during any ground clearance and excavation in the surrounding area of the archaeological features. Although the proposed site has already been levelled out it is possible that other archaeological features, such as cart-ruts will be uncovered, especially if the land has been filled-in to form an even surface for the parking yard. Any features uncovered during works, however dubious they may appear, should be reported immediately to the Planning Authority and the Museums Department to record these correctly if works are to continue.

4.6.3 The development of the site will in no way affect the public right of access to the monument. It should be noted that there is currently no convenient form of public access or route of approach to the monument. It has been agreed during a meeting held on 9 January 1996, at which Mr R Grima of the Museums Department was present, that access to the sorting yard will be from the entrance of the Maghtab landfill whilst that to the archaeological site would be from the road at the rear of the yard.

4.6.4 The visual impact of the development in relation to the Maghtab Tombs is discussed in Section 4.4. The current appearance of the area proposed for development is of limited quality, and, in some places, is of very poor quality. It is therefore considered that the proposed development will greatly improve the visual appearance of the site.

4.6.5 With reference to the Museums Department's concerns over odour emission and noise, the following points should be noted:

- No organic wastes will be handled at the site. There will therefore be no noxious or offensive odours which could affect the publics' enjoyment of the tombs;

- The increase in noise levels as a result of this development will be negligible in relation to the noise generated by the movement of vehicles and heavy plant at the adjacent landfill.

4.7 Health and Safety and Vermin

4.7.1 Any waste management scheme has the potential to impact upon health and safety during both the construction and operational phases of the project. A Working Plan (making reference to relevant national and international standards), will be developed by the operators and employees should be provided with appropriate training for the tasks which they will be expected to undertake in order that health and safety impacts are minimised.

4.7.2 In view of the proximity of the existing landfill there is a small risk that landfill gas arising from the degradation of wastes deposited there can migrate and accumulate in enclosed spaces; the presence of an ignition source and sufficient oxygen could result in an explosion. As such, building design will take this into account and a gas alarm will be installed within the building to alert staff to the presence of landfill gas. In such cases, building excavation would occur and emergency ventilation procedures implemented; potential sources of ignition would be extinguished.

4.7.3 In view of the fact that putrescible wastes will not be handled at the sorting yard it is not envisaged that vermin will be attracted to the site. Additionally good site practice will eradicate the indiscriminate dumping of waste at the existing site, waste which could possibly encourage the influx of vermin.

4.7.4 Waste spillage on the site will be controlled by good site practices and on site supervision and management. It is recommended that a Working Plan will be prepared prior to commencement of operation of the facility that will identify the measures and activities that will be adopted to control such issues.

4.8 Noise Impacts

4.8.1 The proposed development has the potential to increase noise levels in the area of the site in three ways:

- traffic noise;
- construction noise; and
- operational noise

Taking each of these in turn:

Traffic Noise

4.8.2 In order for there to be an audible increase in noise levels there needs to be a noise increase a 3dB(A), equivalent to 50% increase in traffic movement. In view of the number of vehicles currently visiting Maghtab Landfill and the current site as well as local traffic using the road, it is highly unlikely that the extra vehicles (mainly small vans and private vehicles) will exceed

50% of the existing traffic volume. As such, noise impacts from this source will be insignificant.

Construction Noise

4.8.3 Noise resulting from the construction of the sorting yard will be derived from a variety of plant that will be present on site. The construction of the facility will be relatively short-term (about 9 months) and will only occur during daylight hours. The main construction activities can be broken down into the following:

- Site clearance (and levelling if required).
- Earth excavation (for services, foundations and reservoir).
- Installation of foundations.
- Building erection.
- Plant delivery and installation.

4.8.4 In view of the relatively small-scale of the development and the limited amount of building involved, it is envisaged that the numbers and types of plant required at the construction stage will be extremely limited. The noise levels generated by construction plant operating at the development are likely to be insignificant when compared with the noise levels generated by dozers, compactors and waste delivery lorries normally associated with landfill operation.

Operational Noise

4.8.5 The development has the potential to generate noise from the following sources:

- vehicles movements
- compactor,shredder and crusher unit
- emergency generator

Vehicle Movements

4.8.6 Traffic movements associated with the site are discussed in paragraph 4.8.2; this section concludes that it is highly unlikely that vehicle movements would cause a noticeable increase in ambient noise levels.

Compactor, Shredder and Crusher Units

4.8.7 Use of the compactor, shredder and glass crushing units is likely to be sporadic and for short periods of time. The likely sound power level for these equipment will be of the order of between 80 and 90dB(A) (at 1m distance). The noise generated by these units will be attenuated by the presence of the perimeter wall, the distance to the nearest sensitive receptors and the existing noise generated by the Maghtab Landfill and as such is not likely to be discernable above the existing ambient noise conditions.

Emergency Generator

4.8.8 While the electricity required at the site will be made available from the nearest mains power supply, the potential for power failures exist; this necessitates the need for a generator on site to provide an emergency power source. The generator will be located within the garage building which will provide adequate sound insulation in the event of a requirement to use the generator.

4.9 Summary

By way of a summary of the predicted impacts that will occur during the construction and operation of the site, an impacts matrix has been prepared. This is attached as Table 4.1.

## CONSTRUCTION PHASE

| Phase | Extent of Effect | Type and Magnitude of Potential Effect | Scope for Mitigation or Enhancement Measures |
|---|---|---|---|
| Air Quality | S | • | + |
| Water Quality | L | • | + |
| Ecology | S | • | + |
| Landscape | L | • | + |
| Traffic | S | • | ○ |
| Archaeology | L | • | + |
| Noise | L | • | + |
| Health & Safety/Vermin | L | • | + |

## OPERATIONAL PHASE

| Phase | Extent of Effect | Type and Magnitude of Potential Effect | Scope for Mitigation or Enhancement Measures |
|---|---|---|---|
| Air Quality | S | • | + |
| Water Quality | L | • | + |
| Ecology | L | ● | + |
| Landscape | L | • | + |
| Traffic | S | • | ○ |
| Archaeology | L | • | + |
| Noise | L | • | + |
| Health & Safety/Vermin | S/L | • | + |

## KEY

**Extent of Effect**

S – Site Only
L – Local Area
I – Island Wide

**Type and Magnitude of Potential Effect***

● Major –ve
• Minor –ve
● Major +ve
• Minor +ve
— No Effect

**Scope for Mitigration or Enhancement Measures**

\+ Mitigation measures included in design or operational procedures. Negative impacts reduced.
— No mitigation or enhancement measures Possible.
○ None required.

* Note: As the impact assessment is qualitative and not quantitative it is not possible to provide indicators as to the difference between major and minor impacts.

Advanced Industrial Systems

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Maghtab Sorting Yard EPS

Impact Matrix

| | |
|---|---|
| Figure No. 4.1 | Scale : NOT TO SCALE |
| Project No. EEMBL099 | Drawn By : N.L.G |
| Cad Ref: FIG 4.1 | |

# 5.0 POST-COMPLETION AUDIT

## 5.0 POST - COMPLETION AUDIT

### 5.1 Introduction

5.1.1 This Environmental Planning Statement has identified that environmental impacts arising from the operation of the Maghtab Sorting Yard will be in most cases, of minor significance. This will be partly due to the relatively innocuous nature of the proposed facility and it's location and partly due to the inclusion of mitigation measures introduced as part of the facility design.

5.1.2 It is noted however that environmental disturbance could occur in the event of some of the mitigation measures not being correctly introduced or the operation and management of the facility not taking place as per the methodology that this statement has assumed (ie. Section 3.0). As such, we recommend that a monitoring audit be considered at the facility by an appropriate environmental consultant. The results of that exercise should be made available to the Naxxar Local Council, the Environment Protection Department the Planning Directorate and the Water Services Corporation.

5.1.3 It is recommended that the audit of the facility be undertaken 1 to 2 months after full operation of the facility has commenced; the time of the audit would be agreed in prior consultation with those bodies and departments identified above. The following areas would be included in the post-completion audit:

- Air Quality
- Water
- Landscape
- Noise

5.1.4 The purpose of the audit would to be ensure that the design measures devised to minimise potential environmental impacts have been incorporated and their efficacy assessed. The audit would be undertaken yearly thereafter.

5.2 Air Quality

5.2.1 The periodic monitoring of the air quality around a development such as the Maghtab Sorting Yard would normally form part of an environmental audit programme. However, the presence of the Maghtab Landfill, which is producing offensive odours and dust emissions is likely to render any air monitoring data for the Maghtab site invalid. It is therefore recommended that air quality monitoring does not form part of the post-completion audit.

5.2.2 It is recommended that all potential sources of odour and dust on the site are visually inspected to assess whether the working methodology as per Section 3.0 of this statement are complied with. Issues that would be assessed would include; inspection of tipping floors for organic wastes; evidence of regular cleaning of tipping floors; maintenance of hardstanding areas etc.

5.3 Water Quality

5.3.1 There are a variety of features incorporated into the design of the facility to ensure that ground and surface waters are not adversely affected by the development. The post-completion audit will check that these features are in-place while their operation, maintenance and their efficacy will be assessed through visual inspection and review of maintenance records.

5.3.2 Prior to the audit, contact will be made with the Water Services Corporation to identify whether water samples are required to be taken as part of the audit.

5.4 Landscape

5.4.1 The landscaping of the facility is an important element of the development, improving both the appearance and ecological value of the site and encouraging good site maintenance practices. The post-completion audit will check that the landscaping proposals have been implemented and that a satisfactory care and maintenance regime is in operation. This will be achieved through comparison with the initial planting programme and a review of the success of vegetation establishment.

5.5 Noise

5.5.1 The control of noise at any waste management facility is an important aspect in the reduction of environmental disturbance. Although it is anticipated that, due to the high existing background noise levels, there will be a negligible noise impact from the sorting yard it is recommended that noise monitoring be undertaken as part of the post-completion audit.

5.5.2 The noise monitoring programme would consist of a series of background noise measurements at potential receivers and noise measurements when the facility is operational. The resultant noise levels can then be quantified and the impacts on sensitive receivers fully assessed.

5.6 Reporting

5.6.1 The results of the audit programme should be compiled within 2 weeks of the audit being completed and will include:

- the methodology adopted for all aspects
- the results of the audit
- a summary identifying areas of compliance or, if relevant, non conformities requiring action.
- follow up action to achieve compliance

# APPENDIX A
# ECOLOGICAL SURVEY

## INTRODUCTION

This report was commissioned by the Advanced Industrial Systems, and intended as an Environmental Planning Statement regarding the construction of a sorting yard.

The site proposed is situated in the North-Eastern part of Malta and lies in a north-easterly direction. It forms part of a valley-system known as *Wied il-Kieli*, and is adjacent to the Maghtab dumping site.

## METHODOLOGY

Site visits were carried out in January, and the animal and plant species growing within the boundaries indicated were noted. Habitat and community types were described using plant indicator species and no attempt was made to produce any full list of the species present in the area since this would require more detailed field studies carried out all over the year. Those species of particular ecological or conservational importance found during the study period were included, and for these, the threat status (if any), is given as in the *Red data Book for the Maltese Islands* (RDB) (Schembri & Sultana, 1989).

## GEOLOGY

The site lies on an outcrop of Lower Coralline Limestone, the oldest rock in the Maltese Islands. Lower Coralline Limestone is a hard, dense, semi-crystalline coarse-grained limestone and gives rise to karstlands, where soil debris remain entrapped; such microhabitats support a very species

rich biota characteristic of the Maltese garigue and steppe (*xagħri*) which at first sight give the false impression of being desolate, arid wasteland.

## Soils

The soils of the area are probably of the *terra-rossa* type characteristic of the Lower Coralline Limestone formations, and according to the type of vegetation present it is probably of poor quality, probably as a result of human influence like dumping and movement of vehicles which enhance erosion. In some of the disturbed areas, the soil was completely covered by rubble and debris.

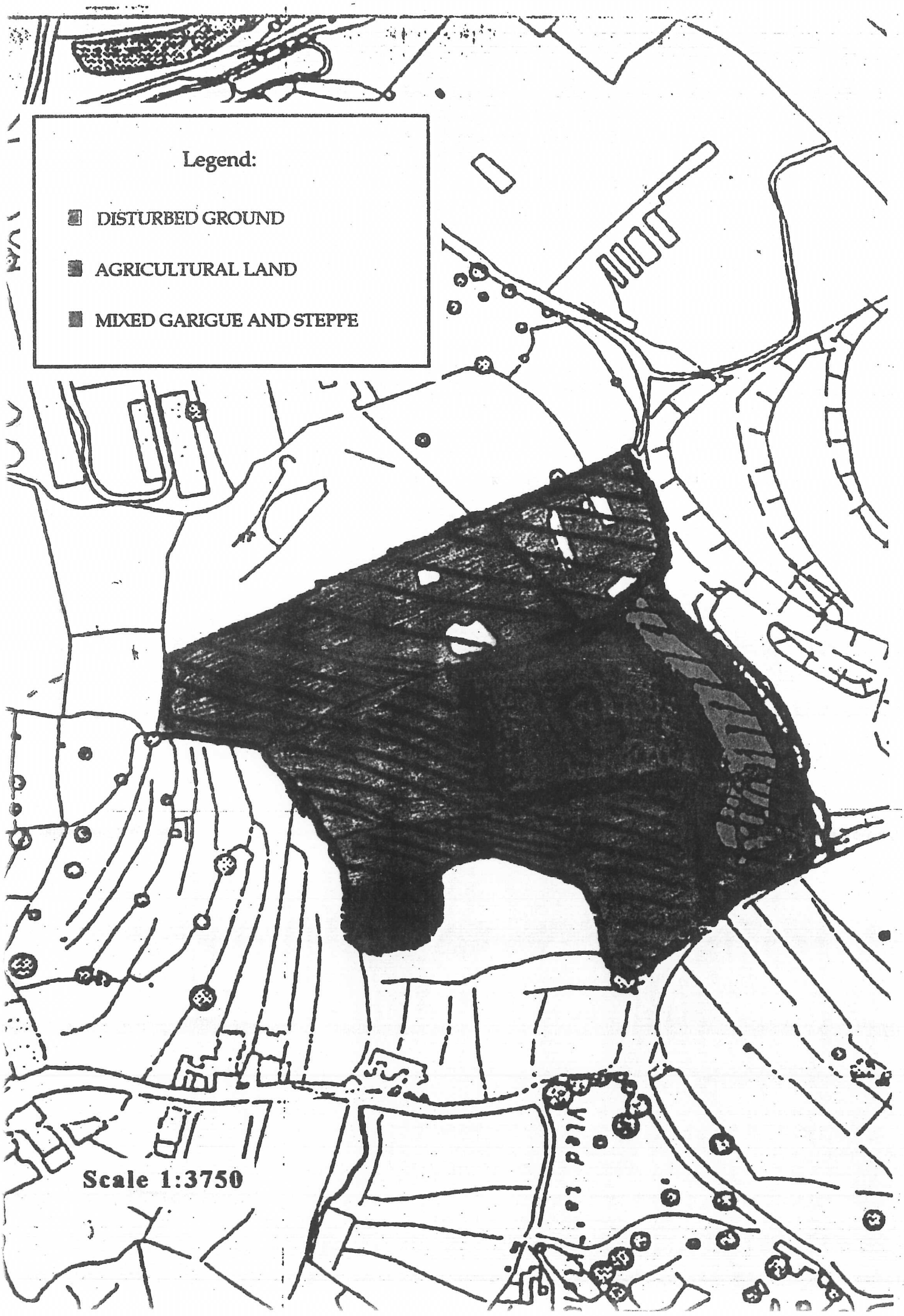
## Description of Vegetation Types

The vegetation types of the site can be mainly divided into three main habitat ecosystems. These are: mixed garigue and steppe, freshwater rock pools and disturbed areas.

- **Mixed Garigue and Steppe**

  The mixed garigue and steppe is dominated by geophytes, hemicryptophytes, and therophytes, with chamaephytes and phanerophytes occurring sporadically.

  The dominant geophytes of the area were the weedy Cape Sorrel, *Oxalis pes-caprae* (Malt.: Haxixa Ngliza), also occurring in its multi-flowered form, forma *flore-pleno* (Malt.: Ingliza Sewda), and the Branched Asphodel, *Asphodelus aestivus* (Malt.: Berwieq). These indicate a high degree of disturbance: in fact, the branched asphodel is


Legend:
DISTURBED GROUND
AGRICULTURAL LAND
MIXED GARIGUE AND STEPPE
Scale 1:3750

considered as the last degradation state of the Mediterranean scrub formations, being characteristic of degraded soils, whilst the cape sorrel is a very common weed of such degraded ecosystems. Other important accompanying species are the Seaside Squill, *Urginea pancration* (Malt.: Ghansar Kbir; **RDB: Restricted Distribution in the Mediterranean**), the Autumn Buttercup, *Ranunculus bullatus* (Malt.: Cfolloq Komuni) and the Lesser Arrowgrass, *Triglochin laxiflorum* (Malt.: Triglokin tax-Xaghri). The Milky Orchid, *Orchis lactea* (Malt.: Orkideja tat-Tikek) was widespread allover the area.

The main hemicryptophytes occurring are the Sea Beet, *Beta maritima* (Malt.: Selq Selvagg); the Fennel, *Foeniculum vulgare* (Malt.: Buzbiez); the Common Ferule, *Ferula communis* (Malt.: Ferla); the Bitumen Trefoil, *Bituminaria bituminosa* (Malt.: Silla tal-Moghoz); and the Sweet Alison, *Lobularia maritima* (Malt.: Buttuniera).

The therophytes are mainly characterised by weeds, which include the Crown Daisy, *Chrysanthemum coronarium* (Malt.: Lellux); the Smooth Sow-Thistle, *Sonchus oleraceus* (Malt.: Tfief); the Toothed Medick, *Medicago polymorpha* (Malt.: Nefel Komuni); the Sun Spurge, *Euphorbia helioscopia* (Malt.: Tenghud tax-Xemx); the Cleavers, *Galium* spp. (Malt.: Harxajja); and the Common Borage, *Borago officinalis* (Malt.: Fidloqqom). Apart from weeds, other therophytes occur, such as the Azure Stonecrop, *Sedum caerulum* (Malt.: Bezzul il-Baqra; **RDB: Restricted Distribution in the Mediterranean**), which is quite common at the periphery of rock pools, in humid crevices and in areas of water catchments.

Chamaephytes are somewhat few and sporadic, certainly as a result of degradation by human agency. The most common are the Mediterranean Asparagus, *Asparagus aphyllus* (Malt.: Spragg Xewwieki) and the Caper Bush, *Capparis orientalis* (Malt.: Kappar Komuni). The other shrubs observed include the Mediterranean Thyme, *Thymus capitatus* (Malt.: Saghtar); the Mediterranean Prasium, *Prasium majus* (Malt.: Te' Sqalli); the Silvery Ragwort, *Senecio bicolor* (Malt.: Kromb il-Bahar); and the Maltese Savory, *Satureja microphylla* (Malt.: Xpakkapjetra; **RDB: Restricted Distribution in the Mediterranean**).

The only phanerophytes present are the Mastic Tree, *Pistacia lentiscus* (Malt.: Deru); the Fig, *Ficus carica* (Malt.: Tina); and the Castor Oil Tree, *Ricinus communis* (Malt.: Sigra tar-Rignu). The latter is typical of disturbed ground, whilst the lentisk may indicate that the area may have been a high garigue prior to human disturbance.

- **Freshwater Rock Pools**

The Lower Coralline Limestone, still supporting the mixed garigue and steppes, also supports a few intact rock pool microhabitats. Most are dominated by the rare Mediterranean Starfruit, *Damasonium bourgaei* (Malt.: Damasonju; **RDB: Vulnerable + Restricted Distribution in the Maltese Islands & in the Mediterranean**); however, it co-dominates with the Maltese Waterwort, *Elatine gussonei* (Malt.: Elatine, **RDB: Rare + Restricted Distribution in the Maltese Islands & Mediterranean**), in a single rock pool. Other important accompanying flora are the Southern Waterwort, *Callitriche truncata* (**RDB: Rare + Restricted Distribution in the Maltese Islands**);

the scarce Sanicle-Leaved Water-Crowfoot, *Ranunculus saniculaefolius* (Malt.: Cfolloq ta' l-Ilma; Restricted Distribution in the Maltese Islands); and the Pennyroyal, *Mentha pulegium* (Malt.: Plejju).

- **Disturbed Ground**

Though most of the site is disturbed, this habitat type was determined by the dumping of debris onto the rock karstland. The dominant vegetation type are weeds, including the Cape Sorrel; the Smooth Sow-Thistle; the Wild Carrot, *Daucus carota* s.l. (Malt.: Zunnarija Selvagga); the Crown Daisy; the Common Ferule; the Common Borage; the Annual Mercury, *Mercurialis annua* ssp. *annua* (Malt.: Burikba); the Holy Thistle, *Silybum marianum* (Malt.: Xewk tal-Madonna); the Sea Beet; the Narrow-Leaved Aster, *Aster squamatus* (Malt.: Nittiena); the White Mustard, *Sinapis alba* (Malt.: Mustarda); the Fumitories, *Fumaria* spp. (Malt.: Dahnet l-Art); and the Nettles, *Urtica* spp. (Malt.: Hurrieq). In some small patches, the Castor Oil Tree dominated.

- **Fauna**

Of the fauna of the area, the most interesting entity resulted being the Door Snail, *Muticaria macrostoma* (= *Lampedusa macrostoma macrostoma*) (Malt.: Dussies; **RDB: Restricted Distribution in the Mediterranean**), which is mostly restricted to the garigue and steppe area. In this same area the endemic beetle, *Otiorhynchus (Arammichnus) moriger* (**RDB: Very Rare**), and the sub-endemic *Stenosis*

the scarce Sanicle-Leaved Water-Crowfoot, *Ranunculus saniculaefolius* (Malt.: Cfolloq ta' l-Ilma; Restricted Distribution in the Maltese Islands); and the Pennyroyal, *Mentha pulegium* (Malt.: Plejju).

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Though most of the site is disturbed, this habitat type was determined by the dumping of debris onto the rock karstland. The dominant vegetation type are weeds, including the Cape Sorrel; the Smooth Sow-Thistle; the Wild Carrot, *Daucus carota* s.l. (Malt.: Zunnarija Selvagga); the Crown Daisy; the Common Ferule; the Common Borage; the Annual Mercury, *Mercurialis annua* ssp. *annua* (Malt.: Burikba); the Holy Thistle, *Silybum marianum* (Malt.: Xewk tal-Madonna); the Sea Beet; the Narrow-Leaved Aster, *Aster squamatus* (Malt.: Nittiena); the White Mustard, *Sinapis alba* (Malt.: Mustarda); the Fumitories, *Fumaria* spp. (Malt.: Dahnet l-Art); and the Nettles, *Urtica* spp. (Malt.: Hurrieq). In some small patches, the Castor Oil Tree dominated.

- **Agricultural Land**

One cultivated agricultural field is present within the limits of the area. This is currently being cultivated with Potatoes, *Solanum tuberosum* (Malt.: Patata). However, another cultivated field occurs in the vicinity of the area, this being cultivated with beans, *Vicia faba* (Malt.: Ful).

- **Fauna**

Of the fauna of the area, the most interesting entity resulted being the Door Snail, *Muticaria macrostoma* (= *Lampedusa macrostoma macrostoma*) (Malt.: Dussies; **RDB: Restricted Distribution in the Mediterranean**), which is mostly restricted to the garigue and steppe area. In this same area the endemic beetle, *Otiorhynchus (Arammichnus) moriger* (**RDB: Very Rare**), and the sub-endemic *Stenosis melitana* (**RDB: Endemic to the Maltese Islands**: recent studies have shown its occurrence in localised areas in Sicily).

Even more interesting to note was the fauna associated with the freshwater rock pools found in the mixed garigue and steppe area. A large population of the Clam Shrimp, *Cyzicus tetracerus* (**RDB: Restricted Distribution in the Maltese Islands**) was observed in the larger rock pools, as well as a small population of the freshwater hydrophilid beetle, *Helochares lividus*. Both are common where found, but species like the Clam Shrimp have an overall patchy distribution in the Maltese Islands. Worth noting was the presence of a single specimen of the Painted Frog, *Discoglossus pictus pictus* (Malt.: Zring; **RDB: Vulnerable + Restricted Distribution in the Maltese Islands & Mediterranean**), locally also protected by Law (Legal Notice 49-1993).

## AFFORESTATION

The introduction of trees in the area may be encouraged, especially in the disturbed areas surrounding the sorting yard building sites, as is also recommended by **Policy RCO 30** of the Malta Structure Plan. However, no afforestation must take place in the areas indicated on the map as mixed

garigue and steppe in order not to endanger the rock pools, garigue and steppe flora and fauna.

List of Recommended Species:

| | | |
|---|---|---|
| African Tamarisk | *Tamarix africana* | Bruka |
| Aleppo Pine | *Pinus halepensis* | Znuber |
| Alerce | *Tetraclinis articulata* | Gharghar |
| Carob | *Ceratonia siliqua* | Harruba |
| Dwarf Fan Palm | *Chamaerops humilis* | Gummara |
| Mastic Tree | *Pistacia lentiscus* | Deru |
| Sea Orache | *Atriplex halimus* | Bjanka |
| Terebinth | *Pistacia terebinthus* | Skornabekk |

Since the site in question is dry and strongly influenced by the salt spray from the sea, typically coastal trees are preferred; e.g. African Tamarisk, Dwarf Fan Palm and Sea Orache. These should be the pioneer species, i.e. the first to be planted in considerable quantity. Once these establish themselves, the soil would be more stable and sheltered; at this point the other species mentioned above may be introduced. Conifers, like the Aleppo Pine and Alerce, should be used in limited quantities, since these may invade nearby karstic areas; on the other hand, these are extremely drought-resistant. Though listed, the Mastic Tree and Terebinth are difficult to obtain.

A monoculture afforestation scheme is strongly discouraged as this is poor in biodiversity and of inferior aesthetic value. A single species planted on a large scale may eventually also become ubiquitous and replace the characteristic vegetational communities.

All the recommended species are indigenous or archaeophytic species (as stated by **Policy RCO 31** [1] of the Malta Structure Plan). The planting of exotic species such as *Acacia* spp., *Eucalyptus* spp. and *Schinus terebinthifolius* is strongly discouraged due to the allelopathic effects (i.e. the secretion of toxins in the soil which inhibit the growth of nearby plants) they produce. Any aliens already present in the area like the castor oil trees should be removed, so that they are stopped from usurping native vegetation. All planted trees should, where possible, originate from the native stock of such species, in order not to contaminate the genome of local plants.

## CONCLUSION AND RECOMMENDATIONS

The proposed site for the sorting yard is mainly disturbed, as are most of the surrounding areas. However, the mixed garigue and steppe support extremely important freshwater rock pool microhabitats, which are locally decreasing and becoming rarer. The rock pools present resulted being extremely rich in species of conservation value, and according to **Policy RCO 10, point 6** (i.e. Natural Freshwater Pools), of the Malta Structure Plan, the mixed garigue and steppe supporting such habitats is classified as a Site of Ecological Importance.

Once completed, the development is not expected to have a direct impact on the ecology of the nearby sites, provided that there is no development outside the present boundaries, and that there are no discharges from the

[1] Policy RCO 31 states that "*Afforestation project sites in non-urban areas will make use of indigenous or archaeophytic (brought by man in prehistoric times, and now naturally occurring) species. The use of exotic (not native to the country) species will be limited to urban areas.*"

sorting yard to the surrounding areas. However, debris, rubble and other dumping of waste products, as well as the atmospheric transfer of dust during the construction phase may damage the nearby rock pools and affect adversely nearby agricultural land and their crop yield.

It is hence highly recommended that:

- the mixed garigue and steppe supporting the rock pools is protected as much as possible from the nearby development, and that **no dumping of any type** (including building material) should be thrown or placed in this area; and outside of the construction boundaries both during the construction and operating phases.

- the mixed garigue and steppe is fenced to safeguard better the rock pools and allow the regeneration of the natural vegetation of the area;

- during both the construction and operating phases, the sorting plant should keep to the building areas and that they also keep to the designated access roads.

- only native and archaeophytic trees are planted and that monocultures are avoided.

- trees are planted only in the disturbed areas indicated on the map next page, and that no trees should be planted in the mixed garigue and steppe area.

- no dumping of any type should be placed in the nearby agricultural land both during the construction and operation phases.

## APPENDIX I:

### LIST OF IMPORTANT PLANTS ENCOUNTERED

Note that this may be incomplete since the area was surveyed only during January; most species grow or are recognisable during spring.

- *Callitriche truncata* Gussone
  Rock pools
  Rare; restricted distribution in the Maltese Islands.

- *Damasonium bourgaei* Cosson
  Rock pools
  Vulnerable; restricted distribution in the Maltese Islands and Mediterranean.

- *Elatine gussonei* (Sommier) Brullo, Lanfranco, Pavone & Ronsisvalle
  Rock pools
  Rare; restricted distribution in the Maltese Islands and Mediterranean.

- *Orobanche muteli* Schultz forma *melitensis* Beck
  (= *Orobanche nana* (Reut.) Noë forma *melitensis* Beck)
  Mixed garigue and steppe
  Endemic to the Maltese Islands.

- *Plantago weldenii* Reichenbach
  Mixed garigue and steppe
  Uncommon.

- *Ranunculus sanicalaefolius* Viviani
  Rock pools
  Scarce; restricted distribution in the Maltese Islands and Mediterranean.

- *Satureja microphylla* (D'Urv.) Gussone
  (= *Micromeria microphylla* (D'Urv.) Bentham)
  Garigue
  Restricted distribution in the Mediterranean.

- *Sedum caerulum* Linnaeus
  Periphery of rock pools and water catchment-crevices
  Restricted distribution in the Mediterranean.

- *Urginea pancration* (Steinheil) Philippe
  Garigue and steppe
  Restricted distribution in the Mediterranean.

- *Urtica pilulifera* Linnaeus
  Disturbed habitats
  Uncommon.

## APPENDIX II:

### LIST OF IMPORTANT ANIMALS ENCOUNTERED

Note that this is very incomplete since the area was surveyed only during January, during which period a number of organisms are not met with.

- *Helocluares lividus* (Forst.)
  Rock pools
  Uncommon.

- *Otiorhynchus moriger* (Reitter, 1913)
  Mixed garigue and steppe
  Endemic.

- *Stenosis melitana* (Reitter, 1894)
  Mixed garigue and steppe
  Restricted Distribution in the Mediterranean.

- *Mitticaria macrostoma* Cantraine
  (= *Lampedusa macrostoma macrostoma* (Cantraine))
  Mixed garigue and steppe
  Restricted distribution in the Mediterranean.

- *Cyzicus tetracerus*
  (quoted as *Eocyzicus* cf. *orientalis* Daday)
  Rock pools
  Restricted distribution in the Maltese Islands.

- *Discoglossus pictus pictus* Otth
  Mixed garigue and steppe area + rock pools
  Vulnerable; Restricted distribution in the Maltese Islands & Mediterranean.

## APPENDIX III:

## PHOTOGRAPHS

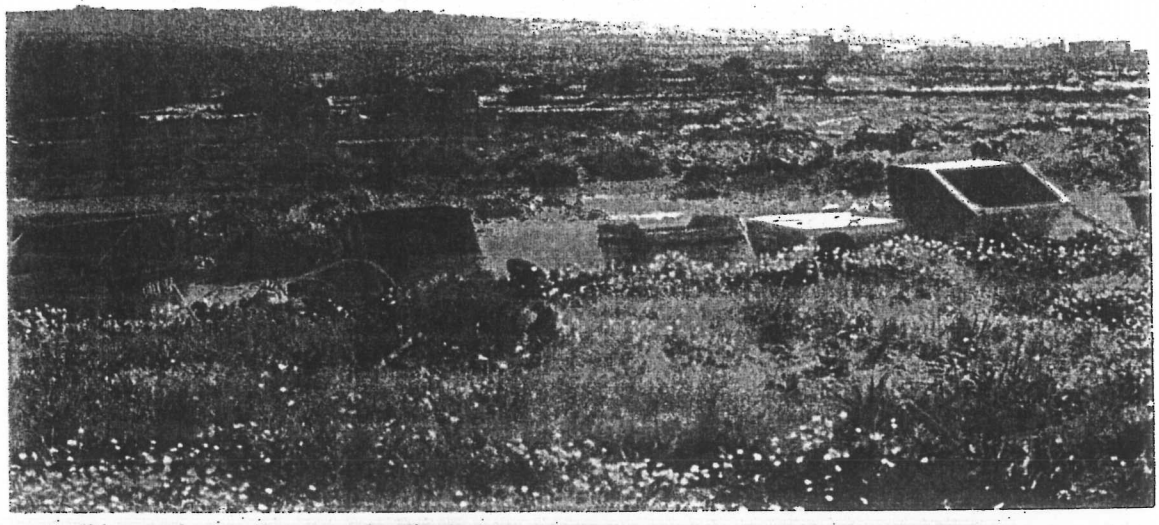

**Plate 1:**
General view of the Area proposed as a Sorting Yard.

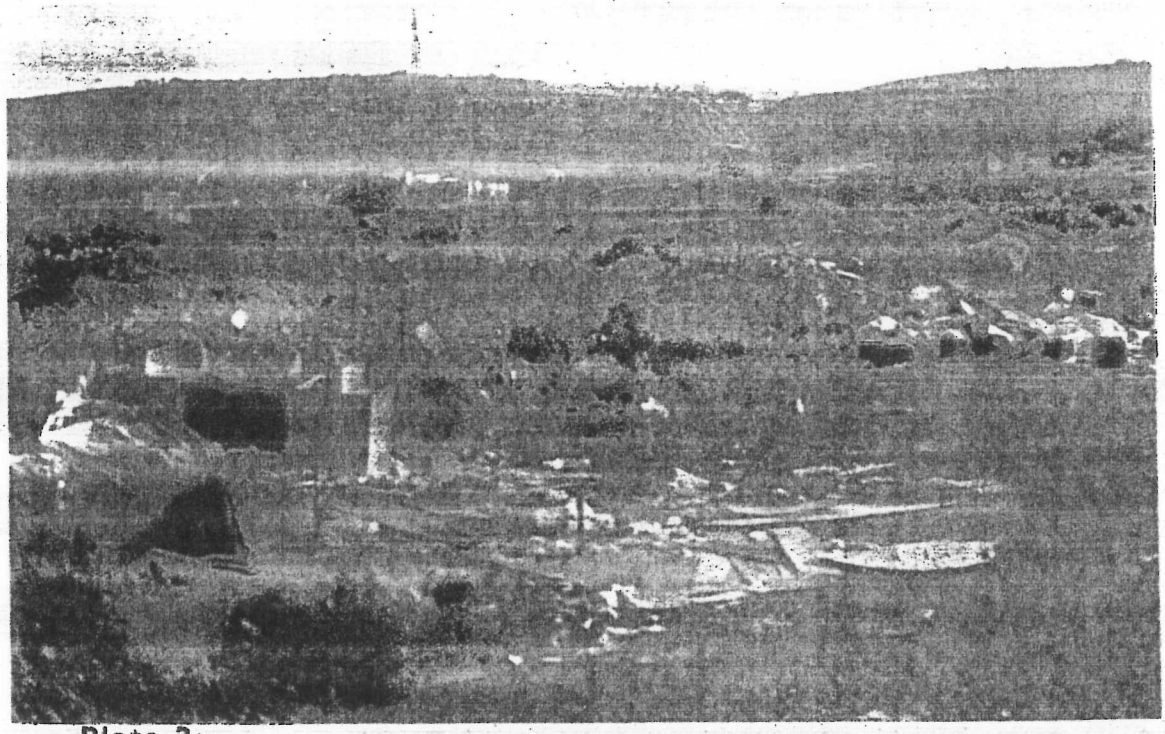

**Plate 2:**
Dumping in the Disturbed Areas surrounding the site.

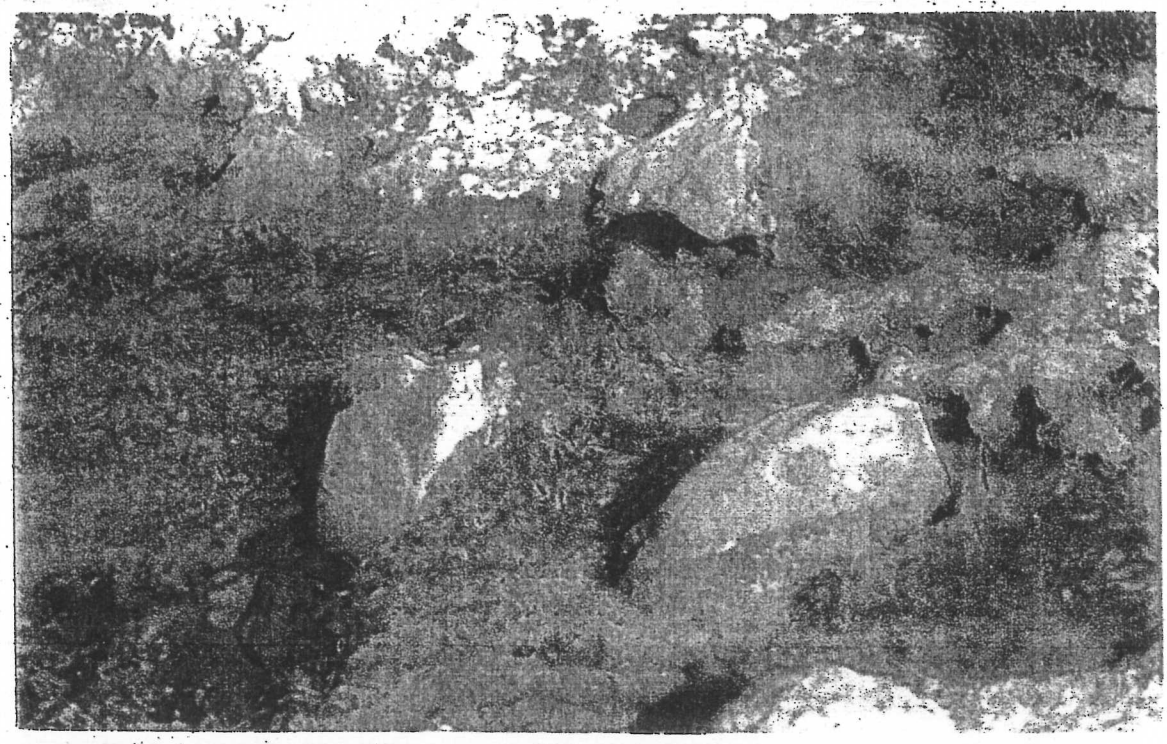

**Plate 3:**
One of the rock pools dominated by *Damasonium bourgaei*.

**Plate 4:**
One of the Milky Orchids, *Orchis lactea*, found in the mixed garigue and steppe, indicating that the area is not extremely disturbed and that regeneration of the natural vegettaion is possible.

## APPENDIX IV:

## FLORA: SPECIES LIST

Note that this species list is incomplete since the area was surveyed only during January; most species grow or are recognisable during spring.

Symbols used for the Raunkaieran Life-forms:

| | |
|---|---|
| Ph: | Phanerophyte (trees) |
| NP: | Nanophanerophyte (small trees & large shrubs) |
| C: | Chamaephyte (shrubs) |
| H: | Hemicryptophyte (perennials with buds at ground level) |
| G: | Geophyte (plants with bulbs or rhizomes) |
| T: | Therophyte (annual plants) |
| Hd: | Hydrophyte (plants living in water) |
| Cl: | Climber |
| 4: | Perennial |
| ⊖: | Biennial |
| O: | Annual |

### DIVISION MAGNOLIOPHYTA

### CLASS MAGNOLIOPSIDA (= DICOTS)

| | |
|---|---|
| **FAMILY ANACARDIACEAE** | |
| *Pistacia lentiscus* L. | NP/Ph 4 |
| **FAMILY APIACEAE (= UMBELLIFERAE)** | |
| *Daucus carota* L. s.l. | G O |
| *Ferula communis* L. | G O |
| *Foeniculum vulgare* Miller | H/⊖ |
| *Smyrnium olusatrum* L. | G/⊖ |
| *Tordylium apulum* L. | T O |
| **FAMILY ASTERACEAE (= COMPOSITAE)** | |
| *Aster squamatus* (Sprengel) Hieron | NP/H/⊖ |
| *Asteriscus spinosus* (L.) Schultz Bipontinus | H 4 |
| *Bellis annua* L. | T O |
| *Calendula officinalis* L. | T O |
| *Centaurea nicaeensis* Allioni | H 4 |
| *Chrysanthemum coronarium* var. *coronarium* L. | T O |
| *Chrysanthemum coronarium* L. var. *discolor* D'Urville | T O |
| *Galactites tomentosa* Moench | C 4 |
| *Leontodon tuberosus* L. | G 4 |
| *Senecio bicolor* (Willdenow) Todaro | C/NP 4 |
| *Silybum marianum* (L.) Gaertner | T/⊖/H |
| *Sonchus oleraceus* L. | T O |
| *Urospermum picroides* (L.) Scopoli ex Schmidt | T O |

| | |
|---|---|
| **FAMILY BORAGINACEAE** | |
| *Borago officinalis* L. | T O |
| *Echium parviflorum* Moench | T O |
| **FAMILY BRASSICACEAE** | |
| *Brassica rapa* L. ssp. *sylvestris* (L.) Janchen | T O |
| *Diplotaxis erucoides* (L.) De Candolle | T O |
| *Lobularia maritima* (L.) Desvaux | C/H 4 |
| *Raphanus raphanistrum* L. | T O |
| *Sinapis alba* L. | T O |
| *Sisymbrium officinale* (L.) Scopoli | T O |
| **FAMILY CALLITRICHACEAE** | |
| *Callitriche truncata* Gussone | Hd 4 |
| **FAMILY CAPPARACEAE** | |
| *Capparis orientalis* Veill. | C/NP 4 |
| **FAMILY CARYOPHYLLACEAE** | |
| *Silene colorata* Poiret | T O |
| *Spergularia bocconei* (Scheele) Ascherson ex Graebner | T O |
| **FAMILY CHENOPODIACEAE** | |
| *Beta maritima* L. | H 4 |
| **FAMILY CLUSIACEAE (= HYPERICACEAE)** | |
| *Hypericum pubescens* Boissier | H 4 |
| *Hypericum triquetrifolium* Turra | T O/H 4 |
| **FAMILY CONVOLVULACEAE** | |
| *Convolvulus althaeoides* L. | H 4 |
| *Convolvulus elegantissimus* Miller | H 4 |
| **FAMILY CRASSULACEAE** | |
| *Sedum caerulum* L. | T O |
| **FAMILY CUCURBITACEAE** | |
| *Echballium elaterium* (L.) Richards | T O/☺ |
| **FAMILY CUSCUTACEAE** | |
| *Cuscuta epithymum* (L.) L. | T O |
| **FAMILY ELATINACEAE** | |
| *Elatine gussonei* (Sommier) Brullo, Lanfranco, Pavone & Ronsisvalle | Hd O |
| **FAMILY EUPHORBIACEAE** | |
| *Euphorbia exigua* var. *exigua* L. | T O |
| *Euphorbia helioscopia* L. | T O |
| *Euphorbia peplus* Linnaeus s.l. | T O |
| *Euphorbia pinea* L. | C 4 |
| *Mercurialis annua ssp. annua* L. | T O |
| *Ricinus communis* L. | Ph 4 |

| | |
|---|---|
| **FAMILY FABACEAE (= LEGUMINOSAE)** | |
| *Astragalus boeticus* L. | H 4 |
| *Bituminaria bituminosa* (L.) Stirton | H/C 4 |
| *Hedysarum coronarium* L. | T O |
| *Hippocrepis multisiliquosa* L. | T O |
| *Lotus edulis* L. | T O |
| *Medicago littoralis* Rohde ex Loisel | T O |
| *Medicago orbicularis* (L.) Bartal | T O |
| *Medicago polymorpha* L. | T O |
| *Medicago truncatula* Gaertner | T O |
| *Scorpiurus muricatus* L. | T O |
| *Trifolium nigrescens* Viviani | T O |
| **FAMILY FUMARIACEAE** | |
| *Fumaria gaillardotii* Boissier | T O |
| *Fumaria parviflora* Lamarck | T O |
| **FAMILY GERANIACEAE** | |
| *Erodium malacoides* (L.) Willdenow | T O |
| **FAMILY LAMIACEAE (= LABIATAE)** | |
| *Mentha pulegium* L. | H 4 |
| *Prasium majus* L. | C 4 |
| *Satureja microphylla* (D'Urville) Gussone (= *Micromeria microphylla* (D'Urville) Bentham) | C/H 4 |
| *Thymus capitatus* (L.) Hoffmannsegg & Link | C 4 |
| **FAMILY LYTHRACEAE** | |
| *Lythrum hyssopifolia* L. | T O |
| **FAMILY MALVACEAE** | |
| *Lavatera cretica* L. | T O/⊖ |
| *Malva sylvestris* L. | T O/⊖ |
| **FAMILY MORACEAE** | |
| *Ficus carica* L. var. *caprificus* Risso | NP/Ph 4 |
| **FAMILY OROBANCHACEAE** | |
| *Orobanche muteli* Schultz forma *melitensis* Beck | T O |
| *Orobanche pubescens* D'Urville | T O |
| **FAMILY OXALIDACEAE** | |
| *Oxalis pes-caprae* L. | G 4 |
| *Oxalis pes-caprae* forma *flore-pleno* L. | G 4 |
| **FAMILY PAPAVERACEAE** | |
| *Papaver rhoeas* L. | T O |
| *Papaver setigerum* De Candolle | T O |
| **FAMILY PLANTAGINACEAE** | |
| *Plantago lagopus* L. | T O |
| *Plantago weldenii* Reichenbach | T O/⊖ |
| **FAMILY POLYGONACEAE** | |
| *Polygonum aviculare* L. | T O/H 4 |

| | |
|---|---|
| **FAMILY PRIMULACEAE** | |
| *Anagallis arvensis* L. | T O |
| **FAMILY RANUNCULACEAE** | |
| *Anemone coronaria* L. | G 4 |
| *Ranunculus bullatus* L. | G 4 |
| *Ranunculus saniculaefolius* Viviani | Hd O |
| **FAMILY RESEDACEAE** | |
| *Reseda alba* L. | T O/Θ |
| **FAMILY ROSACEAE** | |
| *Sanguisorba minor* Scopoli *ssp. muricata* Briquet | H 4 |
| **FAMILY RUBIACEAE** | |
| *Galium* spp. | T O |
| **FAMILY SCROPHULARIACEAE** | |
| *Antirrhinum tortuosum* Bosc | C 4 |
| **FAMILY SOLANACEAE** | |
| *Solanum lutea* Miller | T O |
| *Solanum nigrum* L. | T O |
| *Solanum tuberosum* L. | H 4 |
| **FAMILY TROPAEOLACEAE** | |
| *Tropaeolum majus* L. | T O/H 4 |
| **FAMILY URTICACEAE** | |
| *Urtica dubia* Forsskål | T O |
| *Urtica pilulifera* L. | T O |
| **FAMILY VALERIANACEAE** | |
| *Fedia cornucopiae* (L.) Gaertner | T O |

## CLASS LILIOPSIDA (= MONOCOTS)

| | |
|---|---|
| **FAMILY ALISMATACEAE** | |
| *Damasonium bourgaei* Cosson | Hd O |
| **FAMILY ALLIACEAE** | |
| *Allium* sp./spp. (?) | G 4 |
| **FAMILY ARACEAE** | |
| *Arisarum vulgare* Targioni Tozzetti | G 4 |
| *Arum italicum* Miller | G 4 |
| **FAMILY ASPARAGACEAE** | |
| *Asparagus aphyllus* L. | G/H 4 |

| | |
|---|---|
| **FAMILY ASPHODELACEAE** | |
| *Asphodelus aestivus* Brotero | G 4 |
| **FAMILY IRIDACEAE** | |
| *Antholyza aethiopica* L. | G 4 |
| *Gynandriris sisyrinchium* (L.) Parlatore | G 4 |
| *Romulea columnae* Seb. & Mauri | G 4 |
| *Romulea rollii* Parlatore | G 4 |
| **FAMILY JUNCACEAE** | |
| *Juncus hybridus* Brotero | T O |
| **FAMILY JUNCAGINACEAE** | |
| *Triglochin laxiflorum* Gussone | T O |
| **FAMILY LILIACEAE** | |
| *Urginea pancration* (Steinheil) Philippe | G 4 |
| **FAMILY ORCHIDACEAE** | |
| *Orchis lactea* Poiret | G 4 |
| **FAMILY POACEAE** | |
| *Arundo donax* L. | G 4 |
| *Avena sterilis* L. | T O |
| *Bromus hordeaceus* L. | T O |
| *Cynodon dactylon* (L.) Persoon | H 4 |
| *Hyparrhenia hirta* (L.) Stapf. | H 4 |
| *Phalaris minor* Retz | T O |
| *Poa annua* L. | T O |
| *Pipthatherum miliaceum* Presl | H 4 |

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Schembri, P.J. & Sultana, J. (eds.) (1989): *Red Data Book for the Maltese Islands.* Malta: Department of Information, viii + 142pp.

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# APPENDIX B

# RESULTS OF GROUNDWATER SAMPLE ANALYSIS

| A Hydrological Appraisal of a site at Ta' Zwejra, l/o Maghtab | | |
|---|---|---|
| | | |
| Table 1 : Analyses of Groundwater Sample | | |
| | | |
| Groundwater source : Private Borehole | | |
| | | |
| Date of Sampling : 25.11.95 | | |
| Date of Analysis : 25.11.95 | | |
| | | |
| Analysed by : Marco Cremona | | |
| | | |
| | | |
| Parameter | Unit | Concentration |
| | | |
| Conductivity | mS/cm | 9.89 |
| pH | | 7.4 |
| Temperature | deg. C | 14.6 |
| | | |
| Dissolved Oxygen | mg/l | 16.9 |
| Total Hardness | mg/l as CaCO3 | 1350 |
| | | |
| | | |
| Anions | | |
| | | |
| Nitrate (1) * | mg/l | 77 |
| Nitrate (2) * | mg/l | 74.8 |
| Chloride | mg/l | 3150 |
| Phosphate | mg/l | 0.25 |
| | | |
| Cations | | |
| | | |
| Ammonium | mg/l | <0.5 |
| Total Iron | mg/l | 0.2 |
| | | |
| | | |
| * Two analyses of same water sample | | |

# APPENDIX C

# HYDROLOGICAL APPRAISAL

## Introduction

This report forms part of an Environmental Impact Assessment commissioned by Advanced Industrial Systems Ltd. for the construction and operation of a Industrial Waste Sorting Depot for the sorting and temporary storage of non-hazardous industrial waste. The operations which will take place at the depot will be complementary to those currently being carried at the adjacent Maghtab Dump with the sole exception that the waste will only be temporarily stored at the site. The sorted waste will be recollected and transported to a final destination for recycling/disposal .The site under investigation lies within the confines of the official dumping site at Maghtab.

## Methodology

The hydrological content of this survey is based on a site visit carried out during the period 25 - 26 November 1995 and supplemented by material from the literature. Topographic data for the site catchment area was derived from the Malta East Survey Map (Scale 25,000 - 1984) , geological data was extracted from the Geological Map for the Maltese Islands - Malta (Scale 25,000 - 1993). Climatological data was obtained from the Meteorological Office, Department of Civil Aviation, Luqa.

The hydrology of the Study Area (the proposed site for the Industrial Waste Sorting Depot) can be divided into two general categories : Surface Hydrology and Ground Water. Both are highly influenced by natural physical features such as the topography and geology of the site in question and by anthropogenic influences especially in terms of land use at the Study Area itself and within the surroundings. The impact of the activities arising from the construction and operation of the Industrial Waste Sorting Depot within the stipulated boundaries of the site as indicated in Map 1 on the hydrology of the area will be assessed against the existing hydrological situation. In order to properly assess the existing situation, groundwater samples have been collected and analysed in a laboratory.

Mitigation measures for the limitation of the negative impacts arising from this development are included in the report.

## Description of the site and its environment

The study area covers approximately 0.80 ha. of land and is situated at a distance of approximately 175 metres to the west of the existing entrance to the Maghtab Dump. (see Plates 1 and 2). The longest axes of length and breadth are 105m and 80m respectively. The land surface is vehicle-compacted construction rubble and is almost horizontal. The study areas lies at an elevation of approximately 18.5m above mean sea level.

The site is already being used for the purpose of sorting of waste, the origin of the waste apparently being both from the industrial and touristic establishments (see Plates 3 and 4 ). A number of refuse collection skips (owned by Green Skip Ltd.) border the northern limit of the site (see Plates 1 and 5). Part of the area (80%) comprises land which has been cleared to allow for manoeuvring of Refuse Collection Vehicles (RCVs) and for the placement of skips; the remainder being covered by dumped litter including some construction rubble (see Plate 6). Access to the site is through an unpaved road to the east. The site lies within the physical boundaries of the Maghtab Dump, the general access to which is through a manned gate.

The site is bordered by arable land to the east, and by wasteland on the other sides. The wasteland areas serve as bird trapping and hunting grounds. A number of pig farms and a concrete batching plant lie to the west of the site. The main dumping area of the Maghtab Dump lies to the north of the site.

A shallow valley runs east of the site (south-east of the Maghtab Dump) leading down to the coast at Qalet Marku. The land in the valley is arable but cultivation is limited. Most of the isolated farms in the valley have today been converted to small scrap yards or servicing garages for RCVs.

## Geological and Geomorphological Considerations

Gradual erosion of the overlying Globigerina limestone at the site in question has exposed the Xlendi member of the Lower Coralline Limestone, this formation being of Oligocene age. The karstic terrain (sloping slightly to the south-east) developed by water solution processes over a number of years is presently covered by a vehicle-compacted bed of construction rubble, the thickness of which does not exceed 3 m at the deepest point. The areas bordering the site demonstrate the still-intact karstic terrain typical of the Lower Coralline Limestone. Solution pockets in the rock act as soil traps.

A tectonic fault lies runs in a north-south direction to the east of the site. Downthrow is to the east. However, given the high degree of modification the surrounding landscape has undergone with the development of the Dump during the last twenty years, the fault line is barely distinguishable.

## Hydrology

### 1. Surface Hydrology

The site under investigation lies at the centre of the surface catchment area which comprises the shallow valley (see Plate 7) bordered by the Ta' Hammud plateau to the north, the village of Maghtab to the south and south-east, and the coast to the north. The watershed of the valley runs deep in the south-west to within 750 metres north of Wied il-Ghasel Pumping Station.

There are no natural springs within the confines of the catchment area.

Water only flows along the bed of the valley for a few days after heavy downpours. Given the low gradient of the catchment area, the hydrological response of the catchment area following a storm event is believed to be rather slow. Rubble walls bordering the fields in the valley limit the amount of runoff reaching the sea and soil erosion.

The amount of runoff generated within the Maghtab Dump, the eastern half of which lies within the catchment area described above, is however considerable. This is evidenced by the amount of silt which covers the road leading from the Maghtab Dump to the coast at Qalet Marku Bay (see Plates 8 and 9) . The hydrological response of the dump following a rainfall event is rapid, this arising from the fact that the dump is situated on sloping terrain. Given that a large proportion of the Maghtab Dump consists of construction rubble with large aggregates, the water retention capacity of the Dump is believed to be somewhat limited. Carry-over of fine construction material (silt) from the dump to the sea is therefore considerable. Although the carry-over of silt and uncovered waste takes place along the whole periphery of the Maghtab Dump, runoff from the southern part of the Maghtab Dump is particularly high due to combined effects of the relief of the bedrock at the dump and the steep sides of the dump itself. Runoff from this part of the dump flows into the valley basin and along the road described above, eventually reaching the sea at the bay at Qalet Marku.

Contaminated runoff from the Maghtab Dump may be reaching the cultivated fields in the valley (see Plate 10) and polluting the soil in the valley and the crops growing therein. There exists also the possibility that part of this runoff is being channelled into small storage reservoirs for use as supplementary irrigation during dry periods. This could however not be confirmed from the site visit carried out.

## 2. Groundwater

The groundwater system which lies beneath the site in question forms part of the Mean Sea Level (MSL) Aquifer of Malta.

The Mean Sea Level Aquifer is the most important aquifer in the Maltese Islands at present accounts for about 90% of the total groundwater extraction for the public supply. This aquifer extends from the Pwales valley in the north onto the southern and eastern coast of Malta.

This aquifer lies in the pores and cracks of the Globigerina and Lower Coralline Limestone situated in the region of the mean sea level. This freshwater body owes its existence to the fact that every winter the local rainfall adds more freshwater to the underground store than can be dissipated by direct discharge around the coast. There is no sharply defined plane of separation between the superficial freshwater and the saline water which is underneath as the two water bodies are separated by a 'mixing zone' of brackish water.

The equilibrium of this 'lens' is in a state of flux depending on the fluctuations in rainfall, and to a lesser degree, on the tidal effect. Increasing exploitation of this aquifer, especially during the last 25 years has resulted in upconing of salt water at the site of extraction and a general lowering in the height of the freshwater lens coupled with a deterioration in water quality.

The height of the water table varies substantially within the range 1.5 to 3.5 metres above mean sea level under static conditions for different but neighbouring areas in the central part of the island. It decreases gradually to mean sea level at the coast.

Recharge to the aquifer is predominantly through fissures in the overlying Globigerina Limestone and the Lower Coralline Limestone (where exposed). Porosity and permeability is mostly fissure dependent (secondary permeability) and may therefore these aquifer properties assume a wide spectrum of values for different areas in Malta.

Extraction from the aquifer is made by a system of underground galleries situated near the central axis of the island and also by boreholes which are further away from the centre. A number of private boreholes also extract water for irrigation.

The MSL Aquifer of Malta is highly karstic in nature. This implies that the flow direction and velocity of groundwater flow in the unsaturated and saturated zones of the aquifer are very difficult to determine and assess. In other words, whilst the general flow direction (as determined from piezometric flow levels) may be from the centre of the island towards the coast, underground water channels may be transporting water in the opposite direction. This is of particular concern when one considers the motion of contaminants in the groundwater. Due to the inherent heterogeneity of the aquifer, contaminants leaching from potential polluting sources (such as landfills) located outside the 'Groundwater Protection Zone' i.e. near the coast for example, could

effectively be moving inwards towards the centre of the island and reaching pumping stations and boreholes which extract water for human consumption. The monitoring of the contaminant-leaching process from potential polluting sources (the Maghtab Dump being a major potential polluting source) is a must.

Groundwater Extraction at the Site

There are a number of private ground water extraction boreholes in the near vicinity of the site in question. The extracted groundwater is diluted with rainwater (when available) and used for irrigation. A single windmill was visible in the valley area but was not in an operational condition (see Plate 7).

Water for the public supply is extracted from the same aquifer at Wied il-Ghasel Pumping Station at a distance of approximately 1.25 km to the south of the Study Area. The salinity of the water extracted at this pumping station is known to be relatively high (in the 2000 mg/l chloride bracket). A number of public boreholes in the Naxxar-Gharghur area also extract groundwater for the public supply but these are believed to be outside the sphere of influence of any contamination arising from the waste site.

Ground Water Quality

Groundwater samples were collected from a private borehole located approx. 40 metres to the east of the eastern limit of the site under investigation (see Plates 2 and 3). The borehole depth was estimated to be 20 metres, or approximately at the mean sea level. The water was analysed for salinity content, pH, dissolved oxygen and basic chemical parameters in order to get an understanding of the quality of the groundwater in the immediate vicinity of the site.

The results are shown in Table 1.

The water quality of the ground water at the site in question was found to be of very poor quality with the water having a high salt content (brackish water). The high salinity value limits the possible use of the groundwater to irrigation only, and this only when diluted with rainwater. Regular irrigation of the soil with the groundwater will affect greatly the soil alkalinity and salinity. The groundwater is certainly unfit for potable use since most of the chemical parameters examined greatly exceed the permissible limits. These parameters include specific conductivity, hardness, chlorides, nitrates and nitrites.

The commercial value of the groundwater in the area is therefore negligible.

| A Hydrological Appraisal of a site at Ta' Zwejra, l/o Maghtab | | |
|---|---|---|
| Table 1 : Analyses of Groundwater Sample | | |
| Groundwater source : Private Borehole | | |
| Date of Sampling : 25.11.95 | | |
| Date of Analysis : 25.11.95 | | |
| Analysed by : Marco Cremona | | |
| **Parameter** | **Unit** | **Concentration** |
| Conductivity | mS/cm | 9.89 |
| pH | | 7.4 |
| Temperature | deg. C | 14.6 |
| Dissolved Oxygen | mg/l | 16.9 |
| Total Hardness | mg/l as CaCO3 | 1350 |
| **Anions** | | |
| Nitrate (1) * | mg/l | 77 |
| Nitrate (2) * | mg/l | 74.8 |
| Chloride | mg/l | 3150 |
| Phosphate | mg/l | 0.25 |
| **Cations** | | |
| Ammonium | mg/l | <0.5 |
| Total Iron | mg/l | 0.2 |
| * Two analyses of same water sample | | |

The groundwater was not analysed for heavy metal content, TOC, pesticides etc. although it is believed that leaching of these contaminants from the waste disposed of at the Maghtab Dump may be considerable. In fact, the total iron content of the groundwater was found to be high, possibly the result of the leaching of this element from scrap metal disposed of at the Maghtab Dump.

A high value for nitrate was registered. This value, corresponding with a relative low value for nitrites and ammonium indicate that the groundwater is oxygen-saturated. This is confirmed by the high dissolved oxygen level. The source of the high nitrate content (which when corrected for sea water intrusion represents a concentration of 85.5 mg/l) is believed to be the spreading of liquid waste on fields at the adjacent pig farms (see Plate 11). The high nutrient content in the waters of ponds lying in close proximity to the farms indicate the possible carry-over of nutrients from the slurry ponds to these rainwater ponds (see Plate 12).

## *Impacts arising from the construction and operation of the Industrial Waste Sorting Depot*

It is envisaged that the Industrial Waste Storage Depot takes the form of a covered structure (similar to a partially-enclosed hut) with a concrete base (a platform). Industrial waste is dumped on the concrete platform and then sorted by moving the various waste types to different storage areas within the depot.

Rainfall from the depot cover may be collected for re-use (washing and landscaping purposes) - approximately 4600 cubic metres of rainfall can be collected from the site during one year.

The negative impact of the construction and operation of the depot on the hydrology of the area is limited for the following reasons :

- the amount of land to be incorporated in the development is negligible when compared to the size of the Maghtab Dump.
- the amount of material to be excavated from the site during the construction of the depot is negligible when compared to the amount of construction rubble at the Maghtab Dump. The necessary precautions will have to be taken to ensure that there will be no addition carry-over of excavated material onto the fields downstream of the site.

- leachate (if any) arising from the waste will be channelled to gullies and either treated in-situ or channelled into the public sewer for treatment at the public wastewater treatment plants. Dumping and sorting of industrial waste (the composition of which may be hazardous) on open ground (as is happening today) should not be allowed unless it is proven that such a practice is not contributing to increased concentrations of a selected number of physical and chemical parameters. These parameters should include pH, conductivity, hardness, CO2, suspended and dissolved solids, chlorides, phosphates, sulphates, ammonium, nitrates, the metals Ca, Mg, Na, K, Fe, Cu, Mn, Zn, Pb, Cd, Cr, Ni and As as well as PAHs (polyaromatic hydrocarbons), halogenated hydrocarbons, PCBs, and faecal coliforms.

- the effect of leachate which would arise from the depot in terms of the 'normal' physical and chemical parameters (such as chloride, nitrate and total hardness content, colour, turbidity etc.) on the quality of the groundwater in the region is believed to be negligible since the 'background' levels for these parameters are already high. If the depot is, however to handle wastes of a hazardous nature the above-described mitigation measures (cover, drainage system, leachate monitoring etc.) are an absolute necessity.

- a perimeter wall should be built to prevent the spreading of hazardous wastes from the depot to surrounding areas by the action of wind and vermin.

- a careful assessment of the wastes to be handled at the depot should be carried out in order to determine if the leachates arising from the depot can be adequately treated at the public wastewater treatment plants or whether additional/preliminary in-situ treatment is required.

## Concluding Statement

It is my opinion that the construction of a industrial waste sorting depot at the specified location with have an overall beneficial effect on the immediate and surrounding areas ***provided that the mitigation measures outlined above are strictly adhered to.***

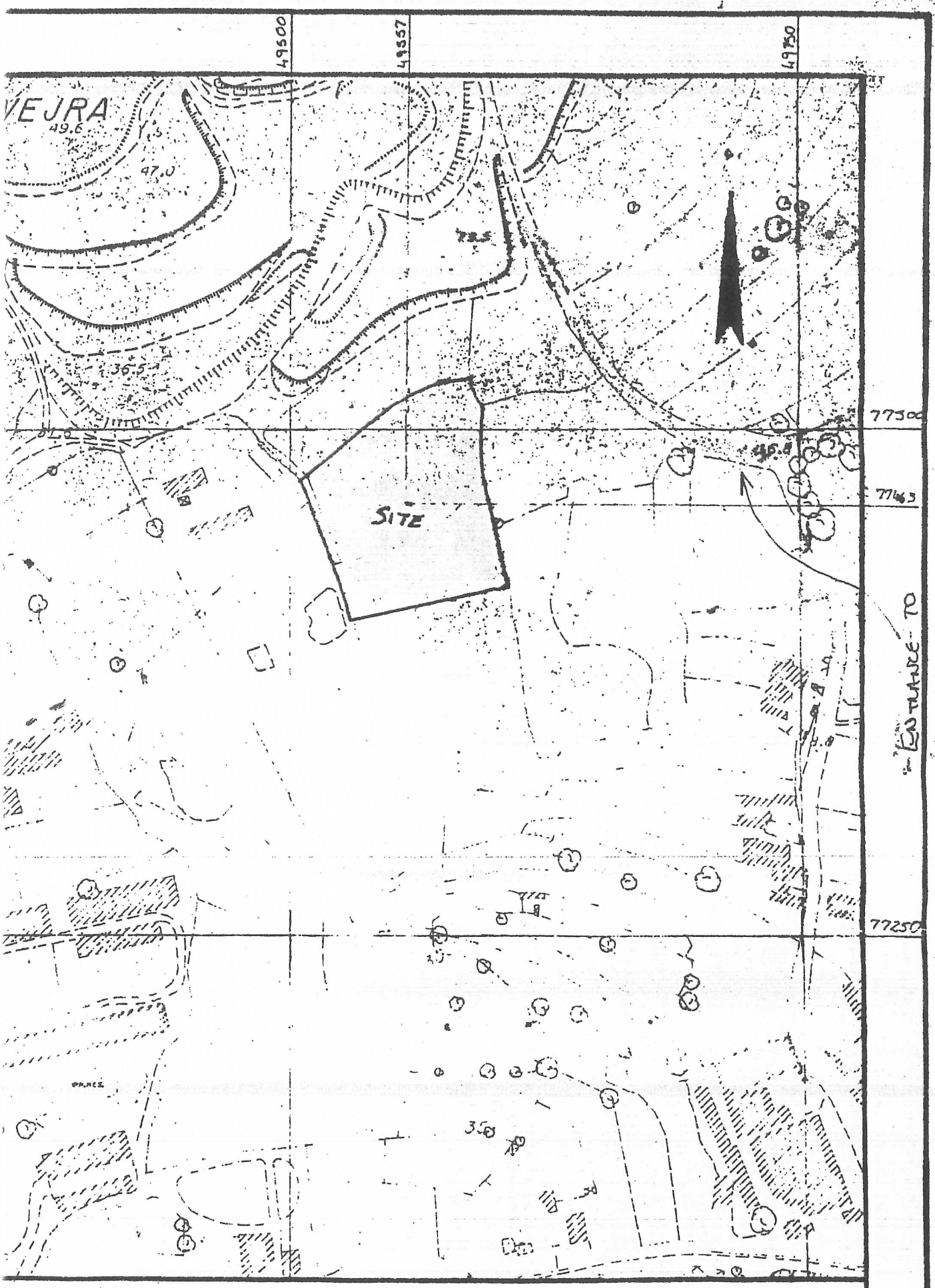
The hydrological benefits include :

- the prevention of dumping of industrial waste on open ground and therefore the leaching of potentially hazardous substances into the groundwater table.

- the prevention of the generation of waste-contaminated runoff from the site which eventually reaches the cultivated fields downstream of the site. Silt carry-over from the site will be negligible once the depot is constructed.

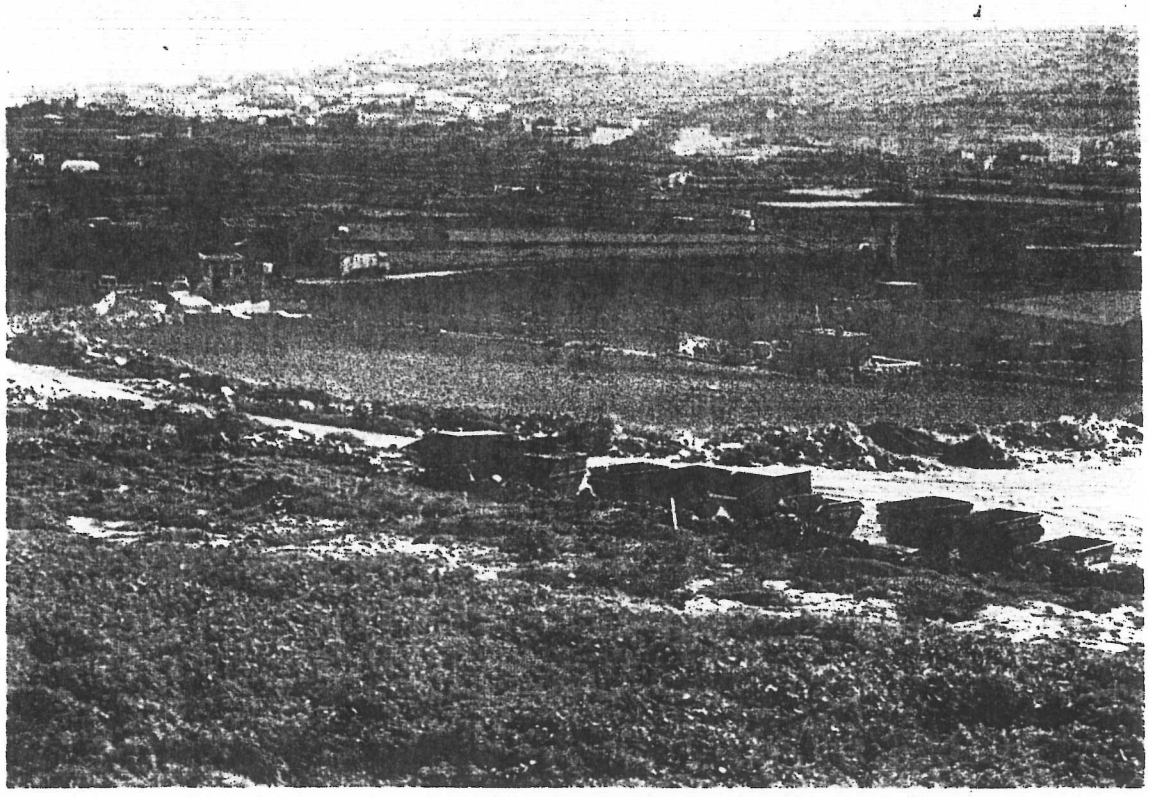
- the collection, storage and re-use of the rainwater collected at the depot for the growing and watering of trees for landscaping of the depot itself and the surrounding areas provides the added benefit of soil stabilisation and reduction in soil erosion.

- the collection, sorting and exportation of industrial waste provides for a general amelioration of groundwater and surface water quality in general.




Plan at Maghtab  Scale 1:2500  S.S. No. 4877

MAP 1



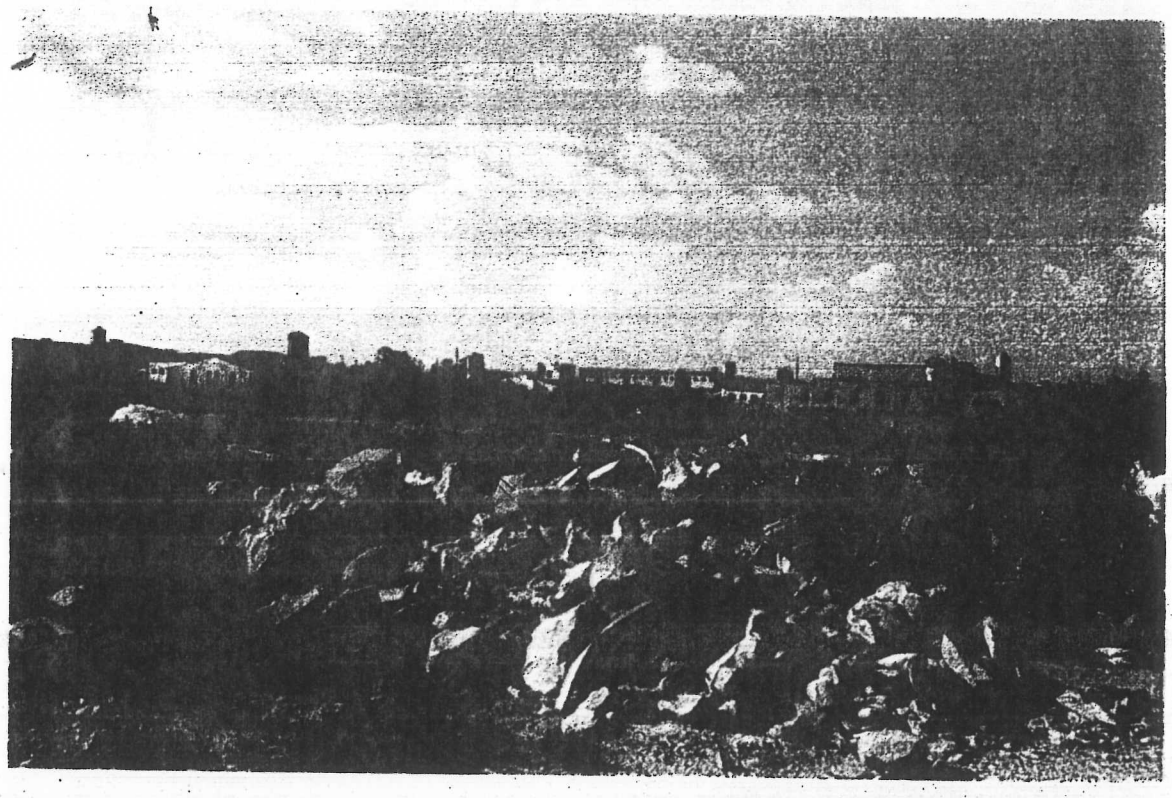
| | |
|---|---|
| **Plate 1 :** | View of site for Industrial Waste Sorting Depot (right hand side). Maghtab dump gate lies to the east (left hand side of photo). The groundwater sampling point lies to the centre of the picture |

| | |
|---|---|
| **Plate 2 :** | Another view of the groundwater sampling point (foreground) and the entrance to the Maghtab Dump (as seen from eastern limit of Study Area). |

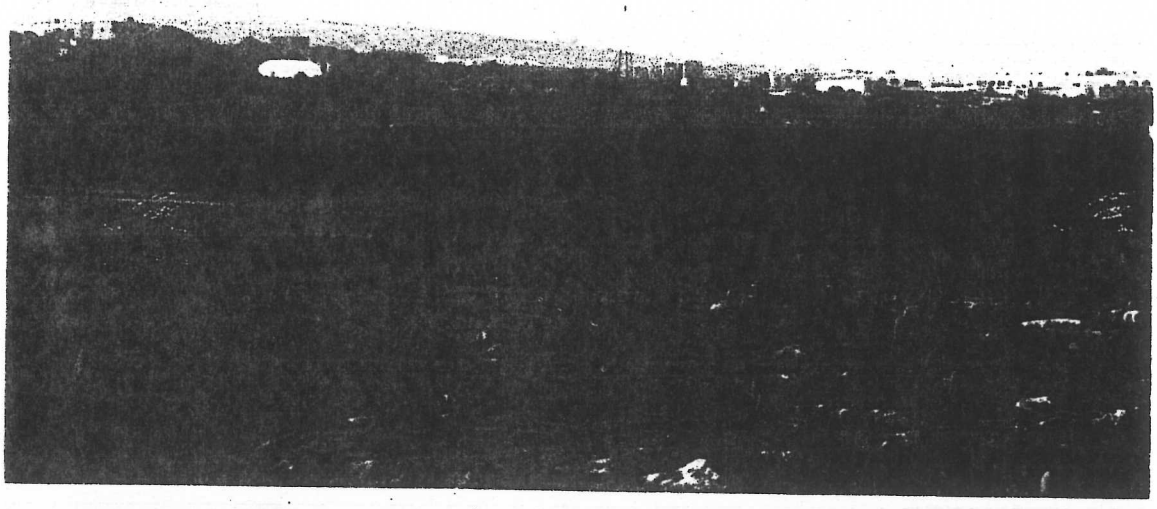

| Plate 3 : | Open dumping of waste at the proposed site. |
|---|---|

| Plate 4 : | Open dumping of industrial waste at the proposed site. |
|---|---|

| **Plate 5 :** | The proposed site for the Industrial Sorting Depot. |
|---|---|



| **Plate 6 :** | Construction rubble at the proposed site. Pig farms can be seen in the background. |
|---|---|



| Plate 7 : | Valley east of Maghtab Dump. |
|---|---|

| Plate 8 : | Silt carried over from the Maghtab Dump by stormwater runoff. |
|---|---|

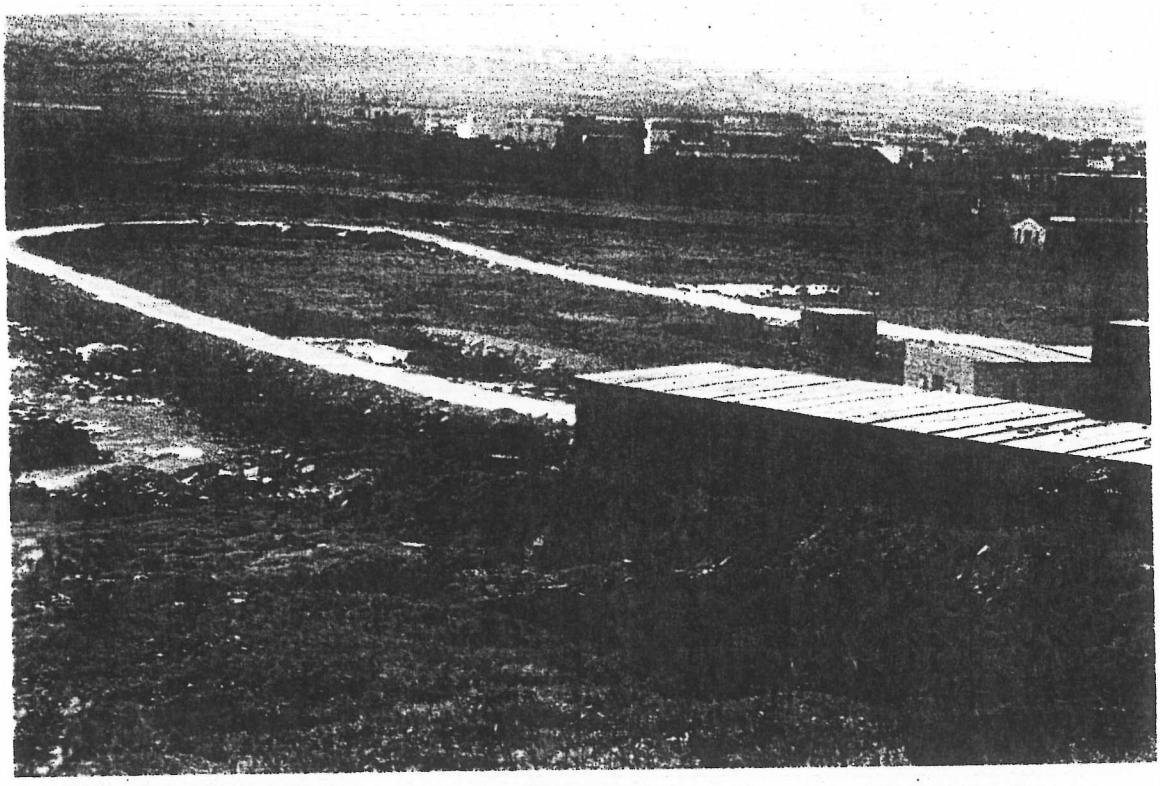
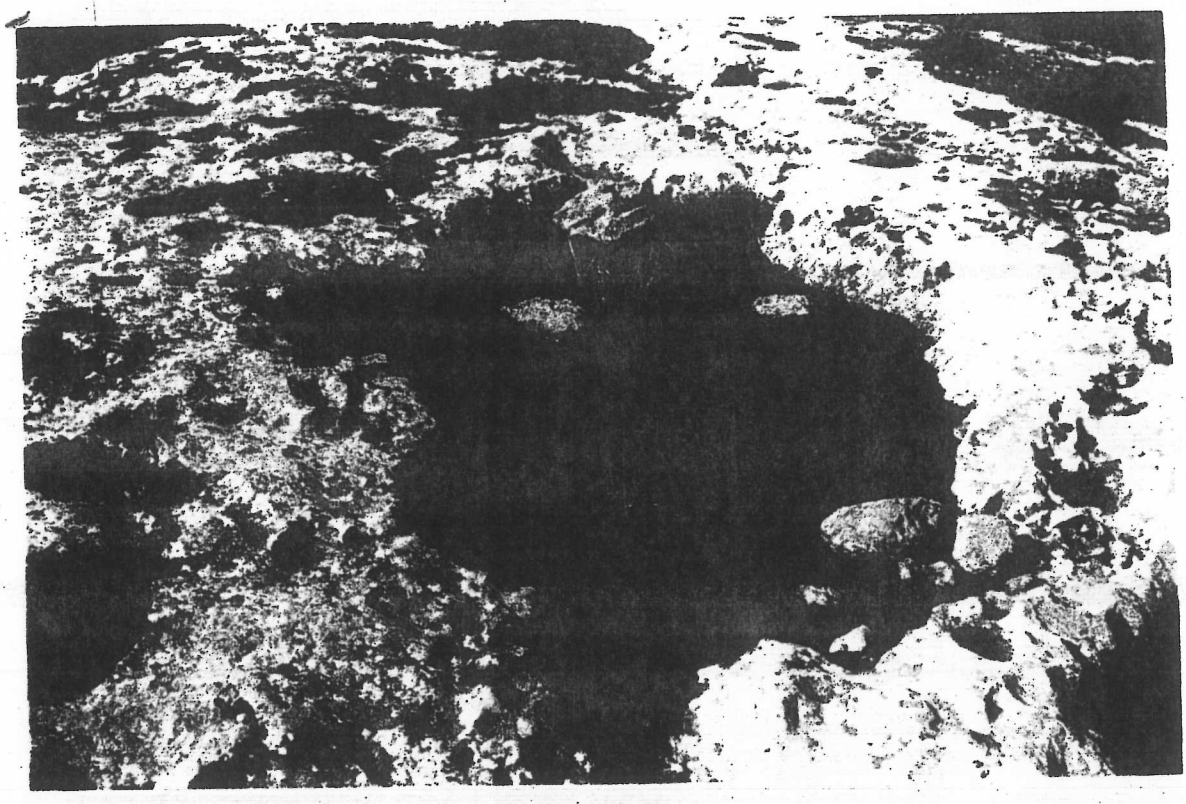


**Plate 11 :** Piggery slurry pools to the west of proposed site. The cleared area on the right hand side denotes the extent of the proposed site.



**late 12 :** Euthrophication in rainwater pools.

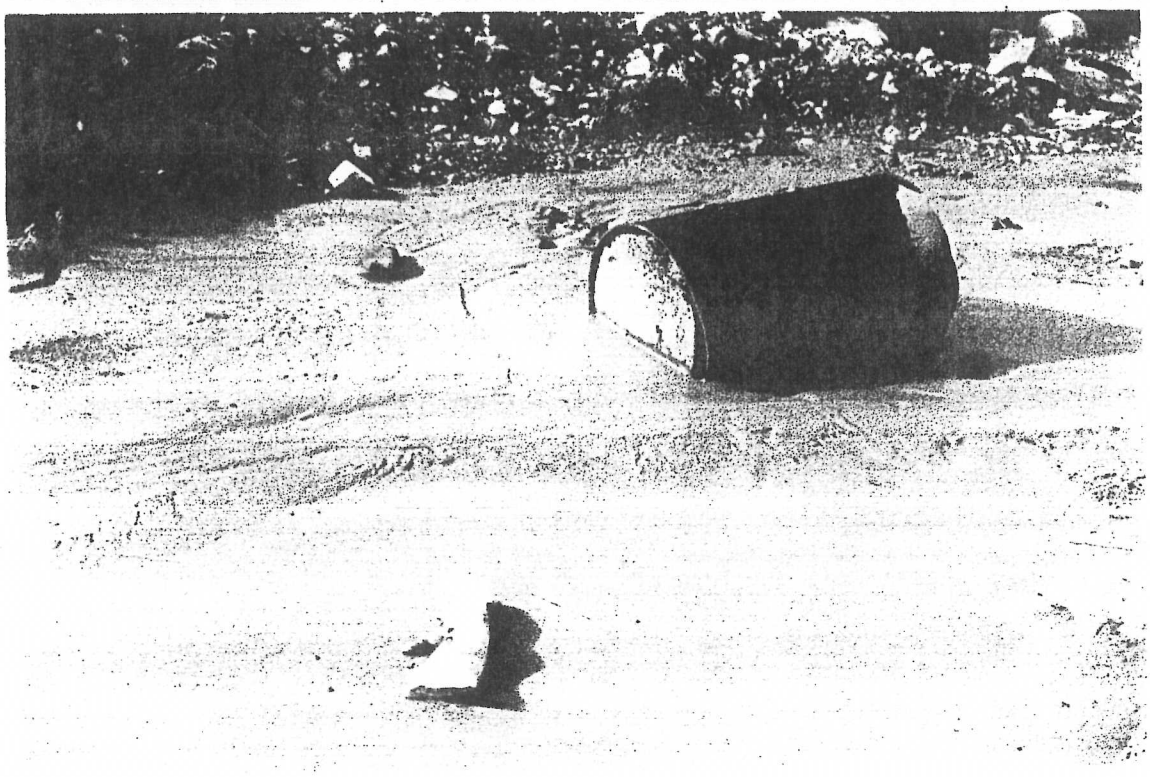
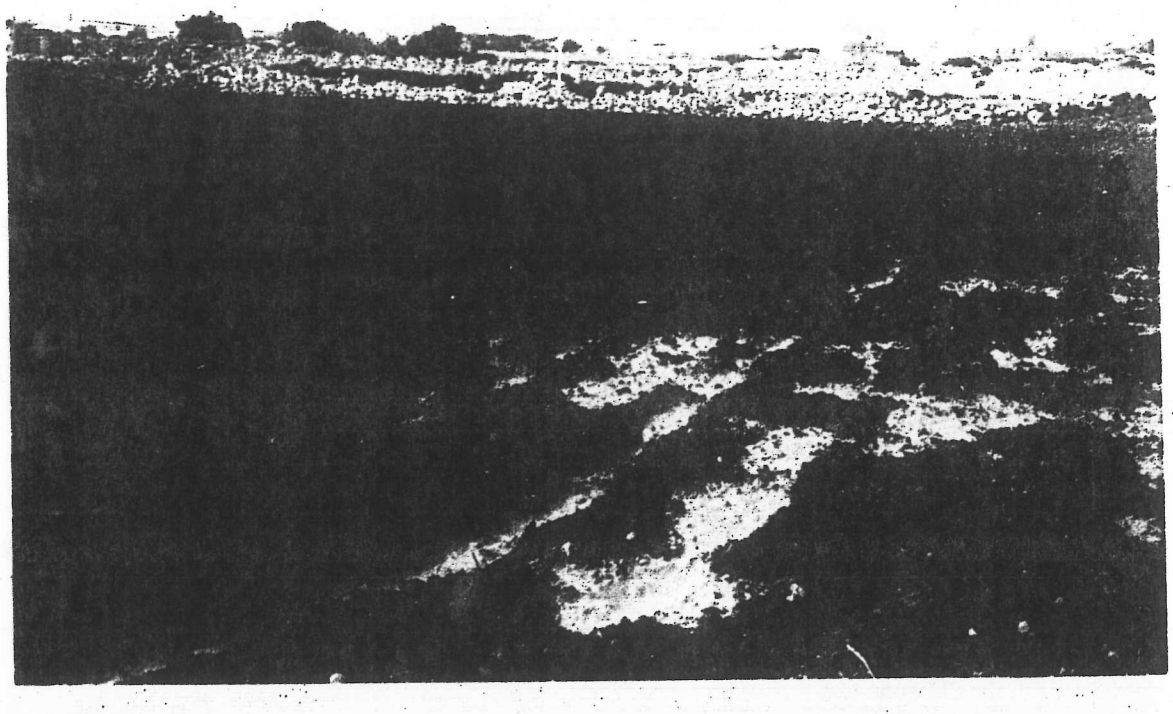


**Plate 9 :** Silt carried over from Maghtab Dump - near Maghtab Dumb entrance gate.



**e 10 :** Silt carried over from the Maghtab Dump onto adjacent fields.

# APPENDIX D

# SPECIES FOR LANDSCAPING IN MALTA

## APPENDIX D

List of indigenous, archaeophytic and acceptable trees for countryside areas, outside development zones and urban fringes. (Urban fringes shall be taken to mean at least 200 metres inwards from the limits to development under the Temporary Provisions Schemes and Local Plans). These trees, shrubs, and plants are recommended for normal afforestation purposes, as well as, other tree planting on abandoned fields and derelict areas, subject to Structure Plan Policy RCO 30.

# TREES

### Broadleaves

| LATIN NAME | MALTESE NAME | ENGLISH NAME |
|---|---|---|
| | | |
| *Ceratonia Siliqua* | Harruba | Carob tree |
| *Ceris Siliquastrum* | Sigra ta' Guda | Judas' tree |
| *Laurus nobilis* | Randa | Bay laurel |
| *Olca europaca* | Zebbuga | Olive tree |
| *Prunus dulcis* | Lewza zghira | Bitter almond |
| *Punica granatum* | Rummiena | Pomegranate |
| *Pyrus amygdaliformis* | Langasa Salvagga | Wild pear |
| *Quercus ilex* | Balluta | Holm/Evergreen oak |
| *Tamarix africana* | Bruka ta' Malta | African tamarix |

### Conifers

| LATIN NAME | MALTESE NAME | ENGLISH NAME |
|---|---|---|
| | | |
| *Cupressus sempervirens* | Cipressa | Italian Cypress |
| *Pinius halepensis* | Znuber | Aleppo pine |
| *Tetraclinis articulata* | G Harghar | Alerce/Sandarae gum tree |

## Palms

| LATIN NAME | MALTESE NAME | ENGLISH NAME |
|---|---|---|
| | | |
| *Chaemerops humilis* | Gummar safrani | Dwarf fan palm |
| *Phoenix dactylifera* | Palma tat-tamal | Date palm |

## Small Trees

| LATIN NAME | MALTESE NAME | ENGLISH NAME |
|---|---|---|
| | | |
| *Crataegus azarolus* | GHanzalor | Azarole/Crete hawthorn |
| *Crataegus monogyna* | Zarghun | Common hawthorn |
| *Darniella melitensis* | Sigra ta' l-irmied/Xebb | Maltese salt tree |
| *Euphorbia dendroides* | Tenghud tas-sigra | Tree spurge |
| *Myrtus communis* | Rihana | Myrtle |
| *Pistacia lentiscus* | Deru | Lentisk |
| *Pistacia torchintthus* | Terebintu | Terebinth/Turpentine tree |
| *Punica granatum* | Rummiena | Pomegranate |
| *Pyrus amygdaliformis* | Langasa salvagga | Wild pear |
| *Rhaminus alaternus* | Alaternu | Mediterranean buckthorn |
| *Rhamnus olcoides* | Ziju | Small buckthorn |
| *Sambucus Cbulus* | Sebbuqa salvagga | Dwarf elder |
| *Sambucus nigra* | Scbbuqa 1-kbira/Sigra tas-scbbuqa l-kbira | Common elder |
| | | |

## Shrubs

| LATIN NAME | MALTESE NAME | ENGLISH NAME |
|---|---|---|
| | | |
| *Aloe vera* | Sabbara/Zabbara | Yellow aloe |
| *Anargyris foctida* | Fula tal-klieb | Stinking bean trefoil |
| *Anthyllis hermanniac* | Hatba s-sewda | Shrubby Kidney-vetch |
| *Capparis oricentalis* | Kappara | Caper |
| *Cistus creticus subsp. crcticus* | Cistu rosa | Hoary rockrose |
| *Cistus cretucus subsp.criocephulus* | Cistu rosa | Hoary rockrose |
| *Cistus monsoeliensis* | Cistu abjad | White cistus |
| *Coridothymus capitatus* | Saghtar | Mediterranean thyme |
| *Cremnophyton lanfrancoi* | Bjanka ta' l-irdum | Maltese cliff-orache |
| *Darniella melitensis* | Sigra ta' l-irmied/Xebb | Maltese salt tree |
| *Dittrichia viscosa* | Tulliera | Golden/Sticky samphire |
| *Ephedra fragilis* | Efedra | Shrubby efedra |
| *Erica multiflora* | Savina/Lehjet ix-xih/Issopu | Mediterranean health |
| *Euphorbia melitensis* | Tenghud tax-xaghri | Maltese spurge |
| *Lycium intricatum* | GHawseg | Southern tea-tree |
| *Ononis natrix* | Broxka | Bush restharrow |
| *Palacocyanus crassifolius* | Widnet il-bahar | Maltese centaury |
| *Palinrus spina-christi* | Xewk tal-kuruna | Christ's thorn |
| *Periploea laevigata ssp. angustifolia* | Sigret il-harir | Wolfbane |
| *Phlomis fruticosa* | Salvja tal-Madonna/Salvjun/Habaq tal-Madonna | Great Sage |
| *Rhus coriaria* | Xumak tal-konz/a | Sumack |
| *Rosmarinus officinalis* | Klin | Rosemary |
| *Prasium majus* | Te' Sqalli | Mediterranean prasium |
| *Ruscus hypophyllum* | Belladonna/Rusku | Greater Butcher's-broom |

| | | |
|---|---|---|
| *Ruta chalepensis* | Fejgel | Wall rue |
| *Salvia fruiticosa* | Salvja | Three-lobed Sage |
| *Sarcopoterium spinosum* | Tursin il-ghul xewwicki | Tjorny burnet |
| *Senecio bicolor* | Kromb il-bahar | Silver ragwort |
| *Spartium junceum* | Cenista safra | Spanish broom |
| *Teucrium flavium* | Borghom | Yellow germander |
| *Teucrium fruticans* | Zebbugija | Olive-leaved/Evergreen germander |
| *Triadenia acgyptica Hypericum aegypticum* | Fexfiex ta' 1-irdum | Egyptian St John's Wort |

## Climbers

| LATIN NAME | MALTESE NAME | ENGLISH NAME |
|---|---|---|
| | | |
| *Asparagus aphyllus* | Sprag xewwieki/Caqcieqa | Mediterranean asparagus |
| *Clematis cirrhosa* | Kiesha/bajda | **Evergreen traveller's joy** |
| *Hedera helix* | Liedna | Ivy |
| *Lonicera implexa* | Qarn il-moghza | Evergreen honeysuckle |
| *Prasium majus* | Te' Sqalli | Mediterranean prasium |
| *Rosa gallica* | Ward taz-zejt | Provence rose |
| *Rosa sempervirens* | Girlanda tal-wied | Evergreen rose |
| *Smilax aspera* | Zalza pajzana/pajzana | Mediterranean smilax/Sarsaparolla |