



THE ENVIRONMENT REPORT 2008



THE ENVIRONMENT
REPORT
tracking the environment

Malta Environment & Planning Authority

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FOREWORD

Environmental concerns have an increasingly high priority in Maltese society, so it is important to keep track of progress and challenges in this area. The Environment Report, which is published every 3 years, helps us do that by monitoring trends related to the most important environmental parameters.

The Report diagnoses the current situation of our environment today and provides us with a holistic picture of Malta's environmental challenges, looking at all sectors and policy areas affecting the environment. In a simple and attractive way, it gives readers a broad understanding of environmental trends, as well as their causes and consequences, with the aim of building up public consensus around issues where action is needed.

In this time of economic slowdown, it is heartening to find that considerable progress is being made in addressing some crucial issues such as air pollution and bathing water quality. However amid the significant improvements the sector has accomplished over the past years, the Environment Report also highlights the growing pressures Malta is facing in areas such as waste management, biodiversity protection, water management, and control of traffic emissions, as well as the ongoing pressures on land. Malta also needs to sustain efforts towards decoupling of economic activity from emissions that give rise to climate change, as well as damaging local air quality. The measures to support energy generation from alternative sources announced in Budget 2010, as well as previous budgets, will help move Malta closer to the low-carbon economy that the global community is increasingly recognising as necessary for future prosperity.

The 2008 Environment Report helps us examine not only the state of the environmental media, but also allows us to examine what this means for Maltese society – for our health, and for our economy. It is very interesting to learn, for example, that the environment is directly used to produce approximately one-fifth of employment, and one-sixth of value added. This should help us understand that the environment is the responsibility of all of us, because it affects us and our future health and prosperity intimately. Reading the Report, one gets a sense of the need for environmental stewardship across government and with all citizens. As the Report states, we all need to take ownership of the environmental situation. For Government, this translates into a need to ensure more effective integration and coordination amongst responsible entities, and to ensure our political commitment to taking action on the issues highlighted. MEPA is committed to do this, and I invite Maltese society as a whole to join us in this ambitious task.



Austin Walker
Chairman, MEPA

EXECUTIVE SUMMARY

The 2008 Environment Report presents an overview of the state of the environment in Malta in 2008. It highlights that while Malta's population has largely met its basic material needs, the population continues to place unsustainable demands on the environment, putting strains on natural resources and processes.

Malta's most significant air pollutants remain particulates and ozone, the concentrations of which exceed EU standards in certain areas. There is a need to assess the key sources of particulate matter, in order to provide an effective policy response. Ozone, which is an air pollutant formed through chemical reactions of primary traffic and power generation emissions, is principally of transboundary origin.

In the area of climate change, Malta needs to sustain efforts towards decoupling of economic activity from greenhouse gas emissions. In this respect, it is important to initiate both supply-side measures, such as investing in a range of cleaner and more efficient energy technologies, including renewables and high-efficiency cogeneration, as well as demand management measures. These would include energy efficiency in buildings and in the transport sector.

The Environment Report also highlights that there is significant potential for improving the overall efficiency of land use in the Maltese Islands, particularly given current over-supply in the residential, commercial and industrial sectors. The potential of using incentives to achieve this merits investigation. In order to reduce wastage and raise efficiency levels of water use, improved water demand management is required. In particular, water pricing needs to be extended to private water supplies, in order to improve demand management over the whole spectrum of water use, with the wider sustainability goals in mind.

In terms of marine areas, the Environment Report states that the next step forward for the protection of the coastal and marine environment is to formulate a national vision for marine areas. This will need to integrate environmental protection with the sustainable use of coastal and marine environments, and take the form of a marine spatial plan, which will build upon the recommendations of various sectoral plans addressing Malta's sea space.

At the same time, in order to meet EU waste management targets, Malta will need to continue to invest mainly in its waste-related regulatory and operational infrastructure, on the basis of new policy instruments, programmes and actions, and to allocate sufficient resources for implementation.

Turning to nature conservation, the Report highlights that 64 percent of habitats and 44 percent of species listed in the Habitats Directive have an inadequate or bad conservation status, while the status of 29 percent of Maltese habitats and 36 percent of Maltese species is still unknown. Stringent measures are required for those species with inadequate or bad conservation status to attain favourable status, while further surveys are needed to assess those with unknown status. In terms of environmental health, the Environment Report notes that since most environmental health issues originate in other sectors, there is need for an augmented inter-sectoral approach to finding and implementing policy solutions.

Concluding, the Environment Report stresses that the environment is a crucial contributor to the Maltese economy: it is directly used to produce at least one-fifth of employment and one-sixth of value added, while also providing amenities for recreation, residence and location of economic activity, and absorbing the by-products of production and consumption. Nevertheless, while Malta has already made significant progress in upgrading its environmental policy capacity, its institutional capacity still needs to improve in terms of human resources and funding, as well as public and private sector investments to upgrade operations and infrastructure.

INTRODUCTION

Welcome to the 2008 Environment Report. This report builds on the tradition of quality environmental reporting found in past editions of the State of the Environment Report in 2005, 2002 and 1998. The 2008 report has been branded to ensure that the tradition of making environmental information ever more accessible to policymakers and the public is kept up, in line with Malta's legal obligations under the Environment Protection Act, and the Aarhus Convention and other related EU Directives.

The Environment Report aims to communicate key environmental issues and trends to policymakers, constituted bodies, government agencies and civil society in a clear and concise way. Its objectives are to increase awareness and understanding among all the stakeholders of key environmental trends, and their causes and consequences, to provide a sound evidence base for improved policy and decision-making at all levels, and to facilitate the effective measurement of environmental performance and progress towards sustainability. The Report is accompanied by a booklet of key environmental indicators, and any readers interested in 'digging down' to find more information and resources will find all the relevant documents including the report, the indicators booklet, educational movie clips, the Sub-reports, background reports, and key datasheets and maps used in the writing of the report, on The Environment Report website www.mepa.org.mt/ter.

As in previous years, the Environment Report covers the entire environment sector. It is the fruit of intense collaboration between the project team and the technical officers at MEPA and within other government agencies and bodies, primarily the National Statistics Office, with which this Report is produced in partnership. The Malta Resources Authority, the Department for Environmental Health, the Malta Standards Authority, WasteServ Malta Ltd, the Ministry for Resources and Rural Affairs, the Malta Maritime Authority, and the Malta Tourism Authority, amongst others, have also contributed significantly to the 2008 Report, as have non-governmental bodies such as Birdlife (Malta) and Ekoskola. The Environment Report monitors trends during the period from 2005 to 2008, but since environmental change tends to be long-term, where time series are long enough, data has been presented for 10 years or from 2000.

This year, the Environment Report takes a broader approach to analysing the environment sector, while retaining the basic structure of the Report, which is based upon the pressure-state-response model. Following this model, the Report first discusses the economic and social pressures that drive environmental change, considers the state of key environmental sectors such as air, fresh water, land and biodiversity, before closing with a review of government policy responses to environmental issues. This year, however, the policy sections in each chapter have been fleshed out, to give readers a better understanding of the key policies and legislative instruments in each field. The policy responses chapter is also lengthier, providing a clearer picture of policy actions taken in the review period. A further innovation is the chapter on the relationship between the environment and economic activity, which traces out the different ways the economy and the environment are inter-related, as well as the chapter on environmental health. These two chapters explore more closely how environmental issues impact our daily lives in terms of our health and our economic activities.

I hope you enjoy reading and using the 2008 Environment Report, and augur that it achieves its aim in highlighting the most important environmental trends and issues in a clear, direct and attractive way.



Martin Seychell
Director, Environment Protection Directorate, MEPA



CHAPTER 1

DRIVING FORCES

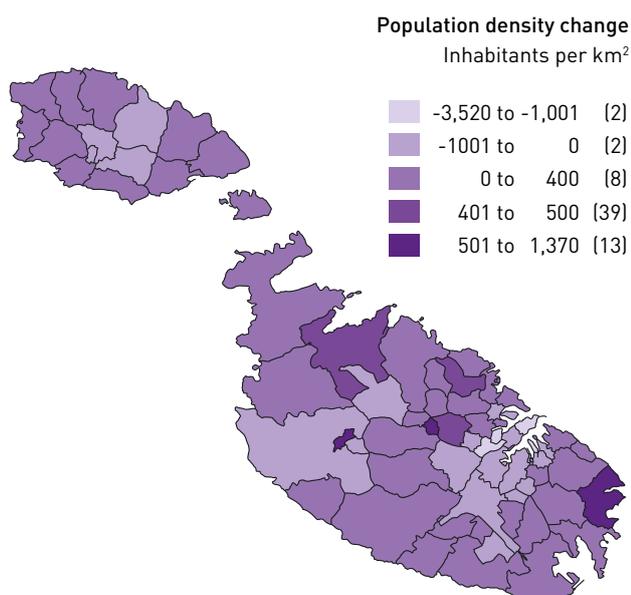
KEY MESSAGES:

- » Malta's population has largely met its basic material needs. However the way these needs have been transformed into demands is often placing unsustainable strains on natural resources and processes in Malta. Future food and fuel consumption patterns require more consideration in terms of sustainability.
- » The number of vacant properties has continued to rise, with 22.4 percent of all dwellings lying permanently vacant in 2005. Urgent measures, including economic instruments and re-orientation of the construction industry towards rehabilitation, are needed to address this issue in ways that do not place undue pressures on affordability and availability of housing, and take into account social and economic implications.
- » Tourism is an important economic sector in terms of GDP but puts significant pressure on the environment due to additional consumption of resources, increase in waste generation and land take-up for tourism infrastructure. The tourism industry will need to focus on ensuring a quality product that prevents undue pressure on Malta's natural resources such as by attracting more tourists in the shoulder months and penetrating those niche markets that are generally more sensitive and supportive towards conservation.
- » Malta's environmental targets and objectives related to air pollution and climate change can only be met by decoupling its growing total energy demand from economic growth. The Islands remain far from reaching EU renewable energy and energy efficiency targets. In order to reach these targets Malta will need to reduce consumption and develop widespread use of alternative technologies. In this regard, the preparation of plans in the energy sector, on renewable energy and on energy efficiency, are welcomed.
- » Malta's continued rise in vehicle numbers is a matter of concern due to the environmental and social impacts of private motor vehicle use, and the high percentage of imports of older and more polluting second hand vehicles is also of concern. The renewal of Malta's car fleet with smaller and more efficient vehicles is urgently required. There is an urgent need to make public transport alternatives at least as reliable and attractive as private car use.
- » Although it is small in terms of employment and contribution to GDP, the agriculture sector is a major environmental player. Agricultural practices may have serious impacts in terms of pollution on the countryside. However good farming practices can positively influence countryside and landscape quality, and sustain key environmental resources such as biodiversity, soil and water.

At the heart of environmental concerns is the relationship between human society and the natural world. In catering for basic needs related to shelter, food and mobility through the respective economic sectors, a series of impacts are produced, which affect the environment in various complex and interconnected ways. This chapter presents trends relating to the socio-economic drivers of environmental change in Malta, regarding the economic sectors of housing, tourism, energy, transport, agriculture, minerals extraction and industry, which all have a strong impact on the environment. The impacts of these drivers on the various environmental media such as air, land and water are discussed in the respective chapters of this report.

Demography is one of the principal drivers of environmental change, affecting demand for housing, transport, minerals, energy and water production. Malta's population grew by 7 percent (26,830) between 1995 and 2005, slowing down from the 9.5 percent growth of the 1985-1995 intercensal period.¹ As at end 2008, Malta's population was estimated to have reached 413,609, growing by 2.6 percent since 2004, higher than the EU-27 average population increase of 1.8 percent² for that period. It is projected that total population will continue to increase slowly (2.3 percent overall) between 2008 and 2025, and then decrease progressively to reach 400,300 in 2050.³ **Although Malta's population has largely met its basic material needs, the way these needs have been transformed into demands is often placing unsustainable strains on natural resources and processes in Malta. Future food and fuel needs require more consideration in terms of sustainability.**

Map 1.1 Population density change (1995-2005)



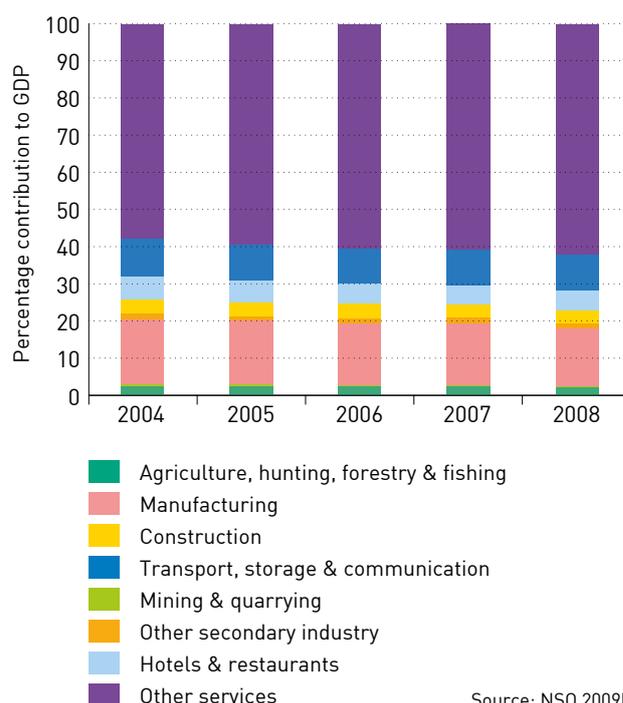
Source: NSO 2007a

Note: Due to changes in locality boundaries in the intercensal period (particularly at Rabat and St. Paul's Bay) densities for 1995 and 2005 are not directly comparable in these regions.

The highest population growth rates in the intercensal period were in the seaside resort towns of Marsasclala (96 percent) and St. Paul's Bay (81 percent), while localities close to the harbour lost most population.⁴ The continued movement of population from older urban areas into newer coastal settlements is a matter of concern as it represents inefficient use of both dwellings and land. In 2008, Malta's population density was at 1,309 persons per square kilometre (km²), increasing by 109 persons per km² since 1995. Population density changes between 1995 and 2005 reflect the trends noted above regarding internal migration (Map 1.1).

Malta's economic structure provides broad insights into the type of environmental pressures it experiences. Consumption of natural resources, use of energy, and the types and volumes of pollutants and waste produced reflect the share of various economic sectors. Gross Domestic Product (GDP) is the most widely used measure of economic activity, although it has its shortcomings as an indicator of economic welfare as non-market transactions are not included.⁵ GDP at constant 2000 prices grew by 1.6 percent in 2008 and by 12.6 percent between 2004 and 2008.⁶ In general the sectors with the highest environmental impacts registered a slight decrease in GDP share between 2004 and 2008 (Chart 1.1). There has been growing activity in the service sector, which was responsible for 76.9 percent of GDP in 2008 and grew by 2.9 percent between 2004 and 2008. Malta also has a significant productive sector that is retreating but still dynamic. Employment grew by 8.4 percent between 2004 and 2008, with 72.5 percent of workers employed in services, up by 4.1 percent from 2004. The growth of the services sector could indicate a shift towards a cleaner economic activity, depending on individual operational performance.

Chart 1.1: Sectoral contributions to GDP

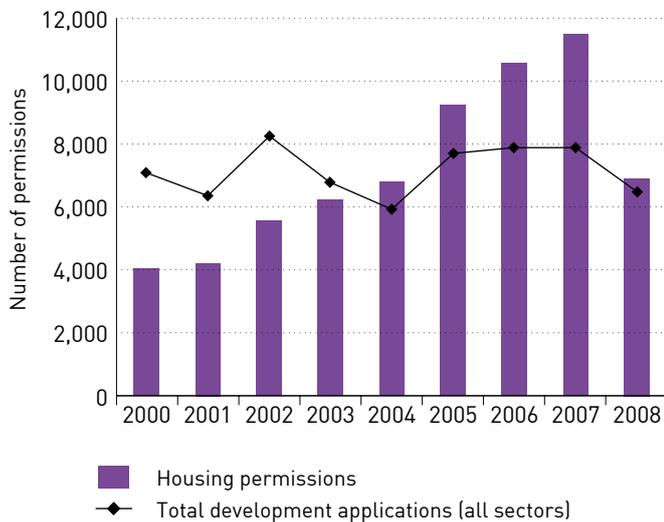


Source: NSO 2009b

The construction industry plays an important socio-economic role, providing employment opportunities and infrastructure for development. However, this comes at the cost of significant environmental impacts associated with most of the stages of the construction chain. These relate to: minerals extraction;⁷ transport; land take-up; construction and demolition waste generation; nuisance to neighbours due to noise, dust and damage to property; and, consumption of energy, water, and other materials. There is, however, much potential for this process to become more environmentally-friendly.⁸

Since housing development is responsible for a hefty share of construction activity, trends in housing permissions granted (Chart 1.2) provide a snapshot of the pressures on land resources from construction. New dwelling permissions reached 6,836 in 2008, decreasing by 40 percent between 2007 and 2008, most likely reflecting the economic climate. Nonetheless, the amount of housing permissions granted is still of concern since it heavily exceeds the annual increase in need for new dwellings, which may be estimated at 1,800 – 2,000 dwelling units per annum.⁹ In 2008, 90 percent of permissions were granted for apartments, suggesting a positive trend in terms of more efficient use of land resources, as long as the properties are actually used.

Chart 1.2: Permissions for dwelling units and applications¹⁰



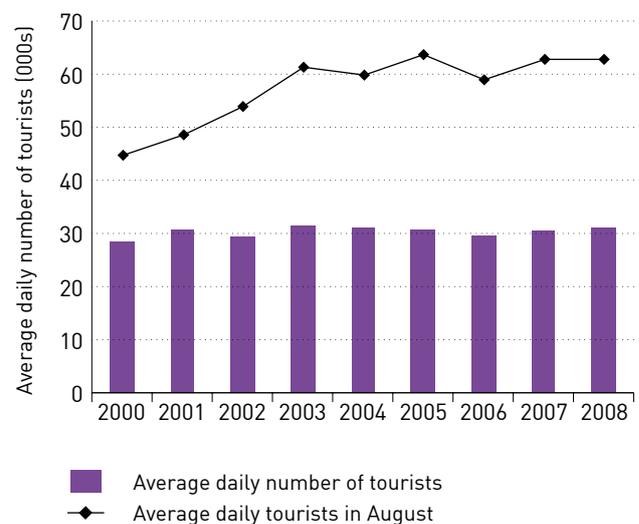
Source: MEPA Dwellings Database

Malta's residential vacancy rate has been found to be high in the past few Census reports, indicating conditions of over-supply in the housing market. **Vacant dwellings amounted to 53,136 (27.6 percent of total stock) in 2005: a 49 percent increase over 1995 figures.**¹¹ Of the 27.6 percent vacancy noted in 2005, 22.4 percent was permanently vacant. Permanently vacant dwellings increased by 89 percent (20,352) between 1995 and 2005, while 5.2 percent accounted for second homes. These high residential vacancy rates point to inefficient use

of land, mineral and other resources. They also raise questions about how much housing provision can increase each year before breaching some important sustainability concerns related to landscape, social tolerance for development, material resources, and the buoyancy of the property market. The latter may already be occurring: the growth of the property price index between 2007 and 2008 was of a -2.3 percent.¹² In this respect the Housing Authority has a role to play in encouraging the re-use of existing buildings rather than the construction of new dwellings. **Urgent measures, including economic instruments and re-orientation of the construction industry towards rehabilitation, are needed to address this issue in ways that do not place undue pressures on affordability and availability of housing, and take into account social and economic implications.**

Despite its important economic role, the tourism sector creates significant environmental impacts, due to additional consumption of resources, pressure on ecologically sensitive areas, increase in waste generation and land take-up for tourism infrastructure. Between 2007 and 2008 tourist numbers increased by 3.8 percent while total nights spent increased by 2.2 percent (Chart 1.3). However the first half of 2009 showed a downturn compared to 2008, with a decline of 13.8 percent over the corresponding period in 2008.¹³ Between 2004 and 2008 tourist numbers increased by 11.5 percent, accompanied by an increase of 0.8 percent in total nights.¹⁴ The uneven distribution of tourists throughout the year remains a challenge, as it subjects environmental infrastructure to high pressures in summer: between 2004 and 2008 the number of daily tourists in August fluctuated, but there was an overall increase of 4.9 percent.¹⁵ The pressures associated with tourism (including domestic tourism) concentrated in particular periods is felt more acutely in Gozo. In summer, Easter, Carnival and long weekends, heavy

Chart 1.3: Average daily number of tourists



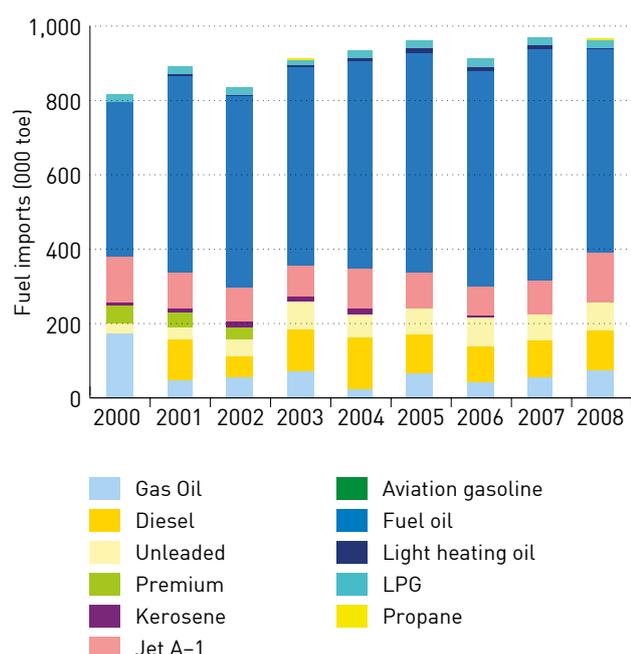
Source: NSO

influxes of visitors present particular management challenges related to traffic, noise and general disturbance.

During the review period a number of initiatives were taken to promote more sustainable tourism,¹⁶ relating to eco-certification of accommodation establishments;¹⁷ product diversification to increase winter visitors; training programmes;¹⁸ and the promotion and safeguarding of Malta's heritage by non-governmental organisations (NGOs). Nonetheless, there is need for more attention to achieve sustainable tourism development: sensitive areas remain threatened by tourism-related and other forms of development; there is continued pressure for developments that may conflict with the environment (such as yacht marinas and artificial beaches); and better integration of tourism objectives with those of other development sectors is required. In this respect, sectoral decision-taking could be enhanced through increased participation of NGOs and the public. **The tourism industry will need to focus on ensuring a quality product that prevents undue pressure on Malta's natural resources, such as by attracting more tourists in the shoulder months, and penetrating those niche markets that are generally more sensitive and supportive towards conservation.**

Malta's dependence on imported fossil fuels for its energy needs contributes significantly to air pollution and greenhouse gas emissions, but also raises socio-economic concerns related to cost and security of supply. Fossil fuel imports provide an indication of fuel use and changing energy demand: between 2004 and 2008, fuel imports increased by 3.14 percent (Chart 1.4).

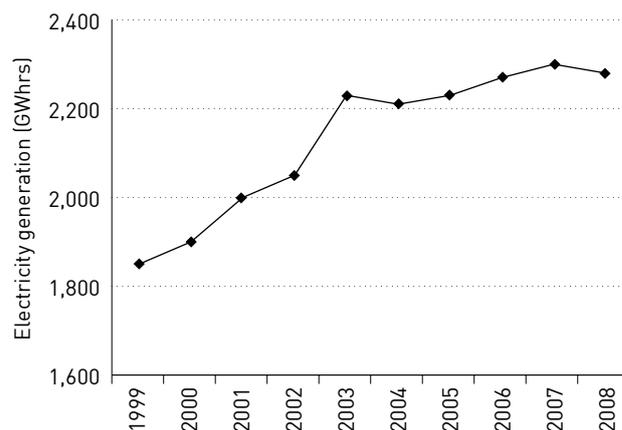
Chart 1.4: Fuel imports by type¹⁹



Source: NSO

Energy generation and transport are the principal consumers of primary energy in the form of fuels.²⁰ In 2008, 65 percent of fuels imported went to electricity generation, seven percent more than in 2004 (Chart 1.5).²¹ Electricity generation decreased by almost one percent between 2007 and 2008. However it is expected that demand will continue to increase due to the coming on line of various large-scale developments.

Chart 1.5: Electricity generation



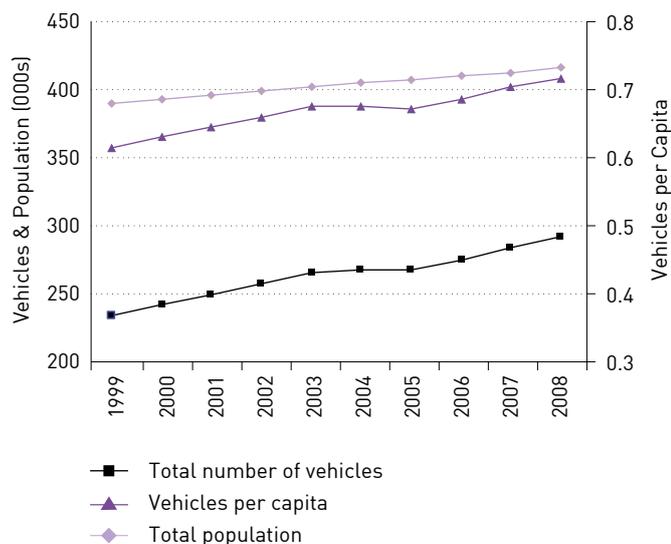
Source: NSO

Total electricity consumption fell slightly (0.1 percent) to 2,260 GWh between financial years 2004/05 and 2005/06, chiefly due to two factors: an 18 percent decrease in electricity lost in distribution or unaccounted for; and significant increases in commercial (10.8 percent)²² consumption. Overall, however, the longer-term trend between 1998/99 and 2005/2006 indicates an increase in electricity consumption. The principal electricity consumers in 2005/6 were domestic (35.5 percent), commercial (34.5 percent) and industrial (28.6 percent). These shares are lower when also considering electricity used in station, lost in distribution and unaccounted for, which amount to 18 percent of the total electricity consumed. Although there have been increasing efforts to promote energy efficiency and the use of renewable energy (RE) in recent years,²³ **the Islands remain far from reaching EU RE and energy efficiency targets. In order to reach these targets Malta will need to reduce consumption and develop widespread use of alternative technologies. Malta's environmental targets and objectives related to air pollution and climate change can only be met by decoupling Malta's growing total energy demand from economic growth. In this regard, the preparation of plans in the energy sector, on renewable energy and on energy efficiency, are welcomed.** A Draft Renewable Energy Policy for Malta²⁴ was published in 2006 and an Energy Efficiency Action Plan²⁵ was published in 2008, while a Draft National Energy Policy²⁶ for Malta was published for consultation in April 2009.

Malta's land transport²⁷ system is highly dependent on private motor vehicles, with corresponding negative effects on human health, the environment and the economy, due to

pollution, congestion and accidents, as well as loss of natural areas, land take-up and waste generation. Registered motor vehicles reached 294,658 in 2008,²⁸ increasing by 2.6 percent between 2007 and 2008 and 8.7 percent between 2004 and 2008 [Chart 1.6]. **The increased growth in vehicle numbers is a matter of concern due to the environmental and social impacts of private motor vehicle use.** Malta also has a high and rising number of vehicles per capita: while between 2003 and 2005 it remained stable at 0.67, this ratio increased to 0.71 between 2007 and 2008.

Chart 1.6: Vehicle fleet per capita²⁹



Source: NSO; NSO 2007c; 2008b; 2009a; 2009e

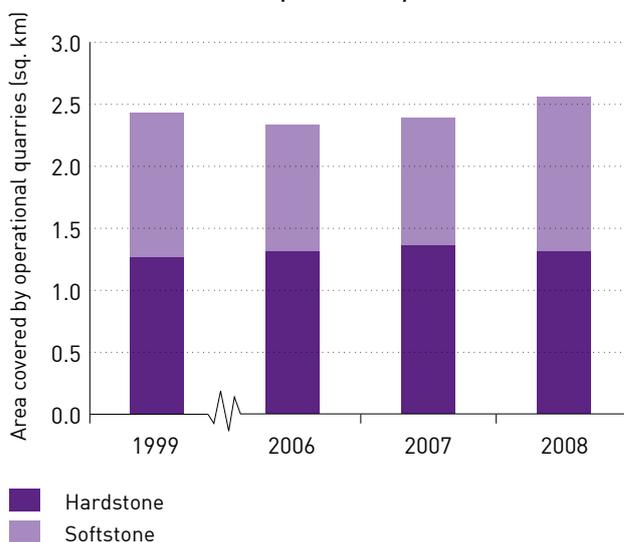
The importation and use of a large number of second hand vehicles (44 percent of imported vehicles in 2008, up from 42 percent in 2004)³⁰ is also a matter of concern, since second hand vehicles in the EU do not have the same emissions requirements as new vehicles. While the use of electric vehicles has a positive impact on air pollution, since these vehicles do not produce emissions at the point of use, the number of electric vehicles in use in Malta remains low. By end 2008 there were 30 registered electric cars, increasing by 17 vehicles since December 2004.³¹ The introduction of hybrid cars also has environmental benefits. **The renewal of Malta's car fleet with smaller and more efficient vehicles is therefore urgently required** to address Malta's air pollution and climate change obligations.

Although an efficient public transport system is one of the principal measures for reducing the impact of transport on the environment, with only 31.6 million commuters in 2008, public transport remains underutilised.³² **There is an urgent need to make public transport alternatives at least as reliable and attractive as private car use.** An important innovation in this sector was the introduction of Malta's first Park and Ride Scheme,³³ but the number of motor vehicles entering the Valletta peninsula remains high. A document³⁴ on the reform of public transport was issued by Government in 2008, aiming to

encourage its use over private car use.³⁵

Mineral extraction has a significant impact on the environment since quarries are a source of noise, vibrations, and dust pollution, and generally have a negative effect on the landscape. In 2007 0.76 percent of Malta's land area was covered by quarries, while in 2008 this rose to 0.81 percent, an increase of 0.016km² such that total quarried area amounted to 2.54km² in 2008 [Chart 1.7]. The numbers of hardstone³⁶ (including lime kilns) and softstone³⁷ quarries did not change in 2008, remaining 28 and 60 respectively. Since 1997, construction and demolition waste has been disposed of in various licensed or otherwise disused quarries,³⁸ facilitating rehabilitation of these quarries and deviating considerable amounts of waste from landfill. This process was stepped up in 2003.

Chart 1.7: Operational quarries



Source: MEPA

The impact of industry on the environment³⁹ is significant due to its use of environmental resources, the wastes it generates, and its effect on the local environment. Enterprises vary considerably in size, nature and potential impact, as they can range from software developers to chemical manufacturers. Environmental issues associated with industrial enterprises include: waste; emissions to atmosphere; discharge of effluent; noise; odours, visual impact; environmental accidents; transport and traffic; energy use; use of water and other raw materials; and, use and disposal of products. Particularly serious issues arising from industrial enterprises include the uncontrolled disposal of hazardous materials such as waste oil and batteries. Through MEPA's environmental permitting system, industries and waste management operators are being directed towards the appropriate disposal and transportation methods for their wastes. Compliance and enforcement are being addressed as a priority through the MEPA reform process. A wide range of hazardous wastes, usually in low quantities, can arise at both workshops and small factories, as well as at larger sites.

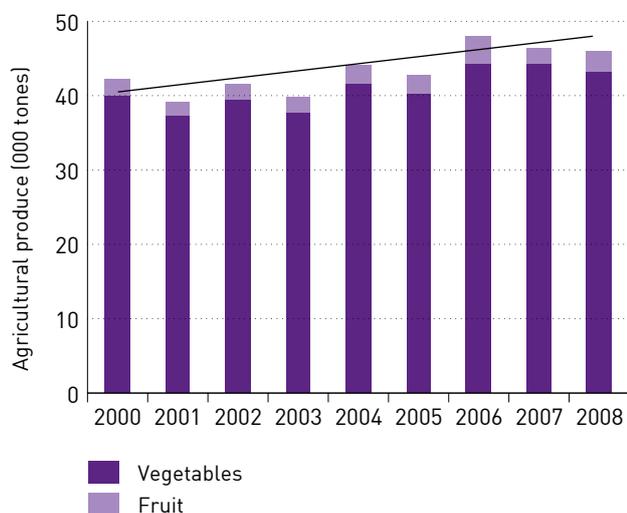
The high population density in Malta and the proximity of commercial/industrial enterprises to residential areas have contributed to a situation where complaints about emissions to air are common. Odours from restaurant kitchens and emissions from vehicle repair garages represent the most common causes of complaint. Indeed, it is often at the local neighbourhood level that industry-environment problems are most apparent, chiefly due to the proximity of many commercial and industrial enterprises to residences. At this level, issues such as litter and general site appearance, unsecured outdoor storage of waste, poor storage practices, open burning of refuse, and traffic, are felt. However a number of firms are known to have taken voluntary initiatives to improve their environmental performance.⁴⁰

Although agriculture is small in terms of employment and contribution to GDP, it is a major environmental player, occupying just over half Malta's land area. The activities carried out by farmers, including the non-activity when land is abandoned, have an impact on a number of environmental media, such as soil, surface waters and groundwater, landscape and biodiversity. Both arable farming and livestock rearing affect the environment, in different ways. In both cases, it is when intensive methods are used that environmental impacts are more pronounced.

Production levels are one of the key determinants of environmental impact, as chemical inputs are often needed to increase production. The principal environmental impacts concerned with arable farming are pollution from fertilisers and pesticides, which affects soil and groundwater quality, and loss in biodiversity when natural areas are illegally converted for agricultural use. Agricultural production (Chart 1.8) follows a cyclical trend, and between 2004 and 2008 there has been an annual increase of 735 tonnes in total production.⁴¹

Intensive methods of arable agriculture include the increased use of water and agricultural chemicals, which serve to boost crop yields. Irrigated⁴² land area⁴³ more than doubled between 2001 and 2005, allowing intensive cultivation to become possible. This might also indicate an increase in illegal water abstraction, leading to the damage of the aquifer in the long run. The degree of livestock farming also has an impact on the environment, particularly on natural fresh water resources, due to waste generated.⁴⁴ In response to these concerns, the current Rural Development Strategy⁴⁵ includes various agri-environment measures that seek to reduce the impact of agriculture on the environment.⁴⁶ This programme builds on the fact that **although agricultural practices may have serious impacts on the countryside, good farming practices can positively influence countryside and landscape quality, and sustain key environmental resources such as biodiversity, soil and water.**

Chart 1.8: Agricultural products sold through official markets



Source: NSO 2002; 2003; 2004; 2005; 2007d; 2008c; 2008d; 2008e; 2008f; 2009f





CHAPTER 2

AIR

KEY MESSAGES:

- » Malta's most significant air pollutants remain particulates and ozone, the concentrations of which exceed EU standards in certain areas. In the case of particulates, the relative contributions of the various local sources, such as traffic and power generation emissions, mineral extraction and construction dust, as well as transboundary sources, need to be quantified in order to ensure an effective policy response. Ozone is an air pollutant formed through chemical reactions of primary traffic and power generation emissions. However it is principally of transboundary origin.
- » Due to increasing traffic, nitrogen oxide concentrations are on the rise and may be a problem in localities where heavy traffic and poor ventilation prevail.
- » A decreasing trend in national annual average sulphur dioxide concentrations was registered between 2004 and 2007, when concentrations fell by 38 percent. This may be attributed to the use of low-sulphur fuels.
- » National benzene concentrations continued to fall in 2007, due to use of cleaner fuels.
- » A number of measures have been taken to address air pollution. Further improvements in air quality will be achieved through accelerating the introduction of more environmentally-friendly transport systems and the use of cleaner and alternative energy sources.

Air quality is one of Malta's most important environmental concerns, due to its direct link with human and ecosystem health. Air pollution arises both from natural sources and human activity, although most pollutants originate from activities such as fuel combustion in transport and energy generation. Air pollution in Malta is composed of both local and transboundary components, with its impact also affected by weather conditions. **The outdoor pollutants of most concern in Malta are airborne particulates and ozone.**⁴⁷ Some of the worst respiratory problems triggered by air pollution are felt particularly by vulnerable groups such as children, the elderly, and citizens suffering from asthma and cardiovascular diseases.⁴⁸

Malta is obliged to monitor and regulate air quality under legislation reflecting two EU directives: the (now revised) Air Quality Framework Directive (AQFD),⁴⁹ and the National Emissions Ceiling (NEC) Directive.⁵⁰ While the former stipulates air quality limit values, the latter gives each Member State maximum emission ceilings for certain pollutants, which must not be exceeded after 2010. The status and trends relating to Malta's major air pollutants are reviewed below,⁵¹ followed by a discussion of policy responses to date.

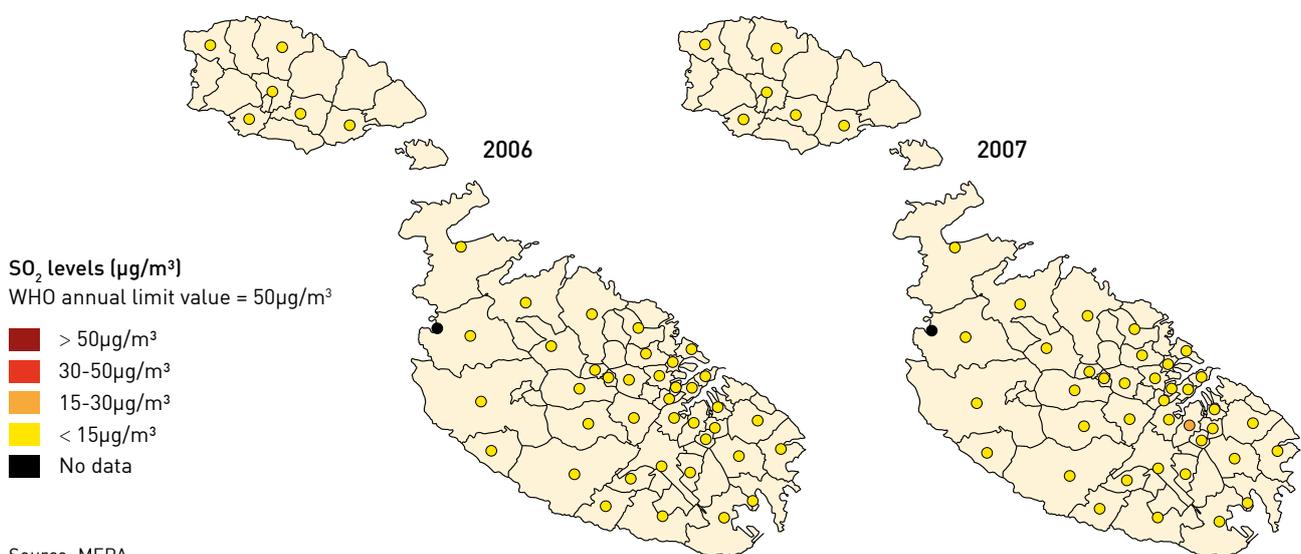
The three principal acidifying substances affecting Malta's air quality are sulphur dioxide (SO₂), nitrogen dioxide (NO₂), and ammonia (NH₃). SO₂ adversely affects the respiratory systems of humans and damages water bodies, soils, vegetation, and limestone buildings. It originates from both natural sources such as volcanoes, and human activities such as fuel and biomass combustion.⁵² SO₂ pollution from international shipping has also become a matter of concern.⁵³ Since sulphate particles combine with other atmospheric compounds to become important contributors to particulate formation, and affect climate,⁵⁴ current international

concerns tend to focus more on climate and human health impacts of the particulate phase of SO₂ than on its primary effect.⁵⁵

There was a decrease of 38 percent in national annual average SO₂ concentrations between 2004 and 2007, from 12.4µg/m³ to 7.5µg/m³, which may be attributed to the use of low-sulphur fuels. Indeed, national SO₂ concentrations remain well below the former⁵⁶ 50µg/m³ WHO annual limit value for human protection. Nevertheless, 2007 marked an increase in SO₂ levels over 2006. National annual average SO₂ concentrations increased by approximately 39 percent (from 5.5µg/m³ to 7.6µg/m³) between 2006 and 2007 (Map 2.1). The two percent increase in electricity generation between 2006 and 2007,⁵⁷ together with the 6.3 percent increase in fuel imports⁵⁸ in this period may have contributed to the increased levels of SO₂ noted. The 2007 readings may also have been higher than those in 2006 due to factors such as apparatus inaccuracy and weather conditions. Increases were registered in almost all localities. However, locality averages were all below the 50µg/m³ WHO annual limit value. The highest SO₂ levels were recorded in Paola (at 20.2µg/m³) followed by Marsa (14.7µg/m³) and Floriana (12.9µg/m³). At 3.4µg/m³, Xlendi registered the lowest annual average SO₂ concentration in 2007, but this increased from 2006, when it stood at 2.2µg/m³.

Real-time measurements indicate that the daily average limit value and hourly limit value were not exceeded in any of the four stations in 2007. Total emission estimates (based on fuel data) and calculated as outlined in the NEC Directive indicate a slow rise in emissions. Projections for total emissions of SO₂ in 2010 indicate that Malta will reach an emission value of 8.77 kilotonnes (kt), just below the 9kt emission ceiling in the NEC Directive, if the currently planned policies and measures are implemented effectively.

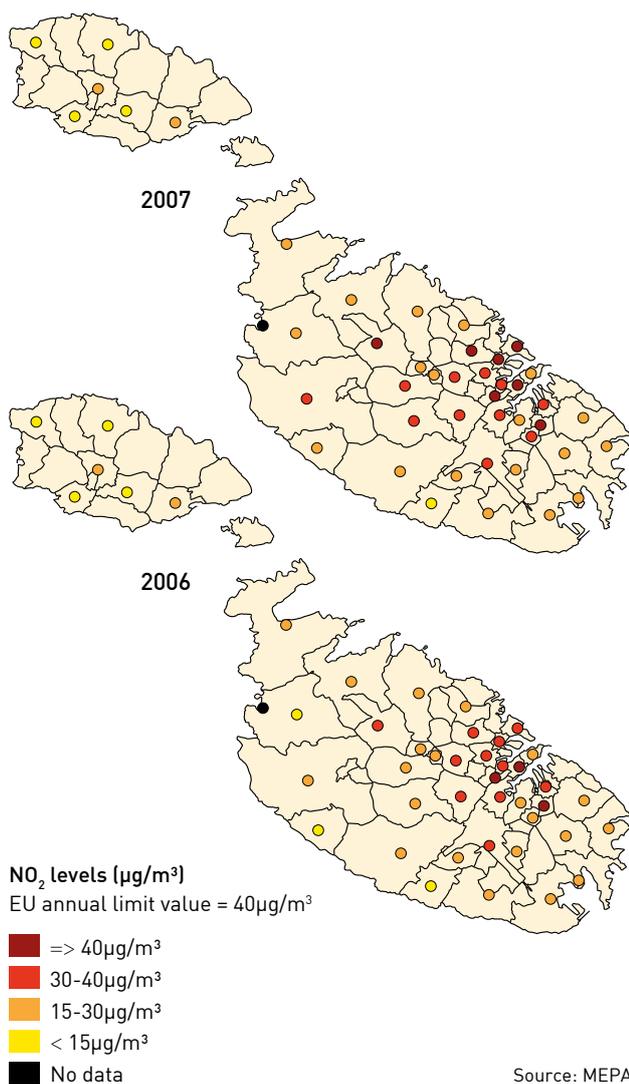
Map 2.1: Annual average SO₂ concentrations by locality



Source: MEPA

NO₂ gas is toxic at short-term concentrations exceeding 200µg/m³, and long-term exposure at lower concentrations. It also interacts with water vapour to form acids, and with other particles to form nitrates and other harmful compounds.⁵⁹ NO₂ is emitted directly from fossil fuel burning, as well as key natural sources such as lightning.

Map 2.2: Annual average NO₂ concentrations by locality



Although the annual average national NO₂ concentration remained well below the 40µg/m³ EU and WHO limit value, it continued to increase between 2006 and 2007, from 25.4µg/m³ to 28.9µg/m³ respectively (Map 2.2). In 2007, values exceeded annual EU standards in six localities, Floriana (50.6µg/m³), Fgura (49.9µg/m³), Sliema (45.4µg/m³),

Mosta (42.0µg/m³), Gżira (41.7µg/m³) and San Ġwann (40.8µg/m³). Furthermore 27 individual sites registered NO₂ levels higher than the EU and WHO limit, with St. Anne's Street, Floriana, rising six percent to 98.4µg/m³ in 2007. This suggests that **nitrogen oxides are on the rise due to increasing traffic, and that this pollutant may be a problem in localities where heavy traffic and poor ventilation prevail.** Real-time measurements for 2007 indicate one exceedance for the EU hourly limit value, in Msida. Nitrogen oxide (NO_x) emission estimates indicate total emissions that are higher than the NEC ceiling, but decreasing, between 2004 and 2007. Projections for 2010 total national emission estimates, taking into account additional measures to those already implemented for NO_x reductions, envisage a decrease in NO_x below the 2010 NEC directive ceiling of 8kt.

Like SO₂ and NO_x, NH₃ contributes to ecosystem's acidification, but is basic in aqueous solutions.⁶⁰ High NH₃ levels in air can cause coughing, burns and irritation to skin, eyes, throat and lungs, while very high concentrations may result in lung damage and death.⁶¹ Major anthropogenic sources of NH₃ include fertilisers, household and industrial cleaners,⁶² and livestock farms.⁶³ NH₃ emissions are estimated to have fluctuated between approximately 1.7kt and 1.9kt between 2004 and 2007. National estimates predict a rise to 2.3kt by 2010, which is below the 3.0kt NEC Directive limit.

Particulate matter (PM), the EU's most serious air pollution threat,⁶⁴ consists of very small suspended solid or liquid particles. High levels of PM are associated with general ill-health, decrease in lung function, asthma or even mortality.⁶⁵ **The relative contributions of the various local sources of particulates, such as traffic and power generation emissions, mineral extraction and construction dust, as well as transboundary sources, need to be quantified in order to ensure an effective policy response.**

Malta's four real-time monitoring stations indicate high levels of PM₁₀⁶⁶ (Charts 2.1 and 2.2). The EU daily limit value of 50µg/m³, which should not be exceeded more than 35 times a year (10 percent of days measured), was exceeded on 56 out of 237 days measured at Msida (24 percent of days measured). At both Żejtun and Għarb, thresholds were exceeded on seven percent of days measured (24 out of the 340 days measured in Żejtun and 13 out of the 182 days measured in Għarb), and at Kordin on five percent of days measured (8 of 161 days). The highest concentration, of 294.5µg/m³ was recorded in Żejtun followed by 237.0µg/m³ in Kordin. The two concentration peaks depicted in Chart 2.1 and 2.2 (28th March and 26th October) correspond with typical events when Sahara dust was being transported to Malta.

Chart 2.1: PM₁₀ concentrations at Żejtun and Kordin in 2007

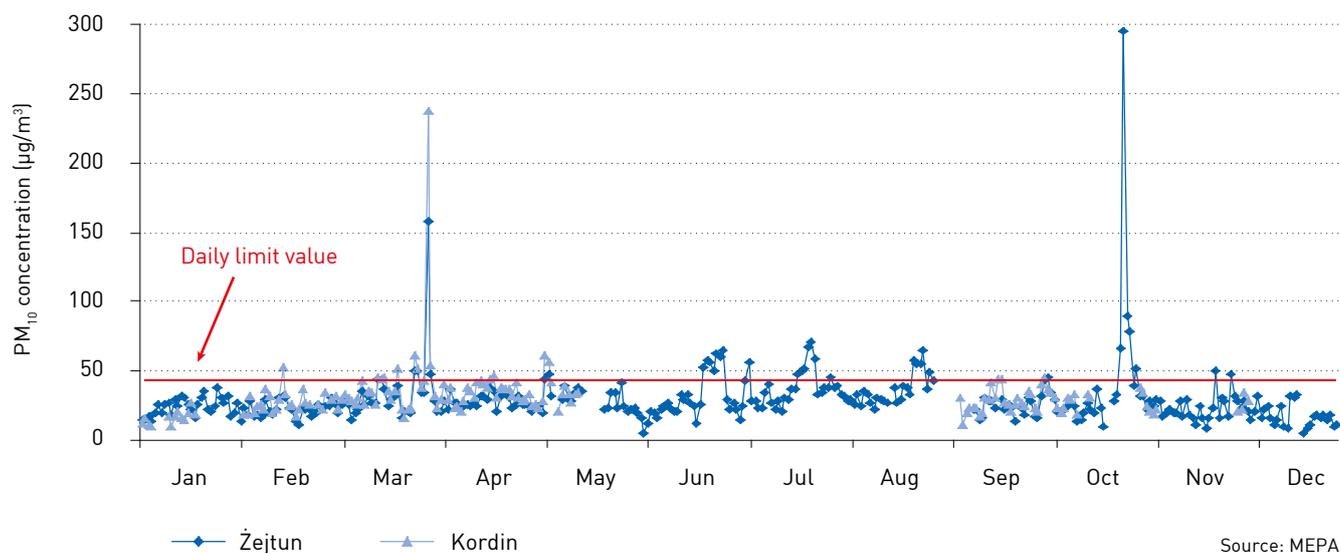
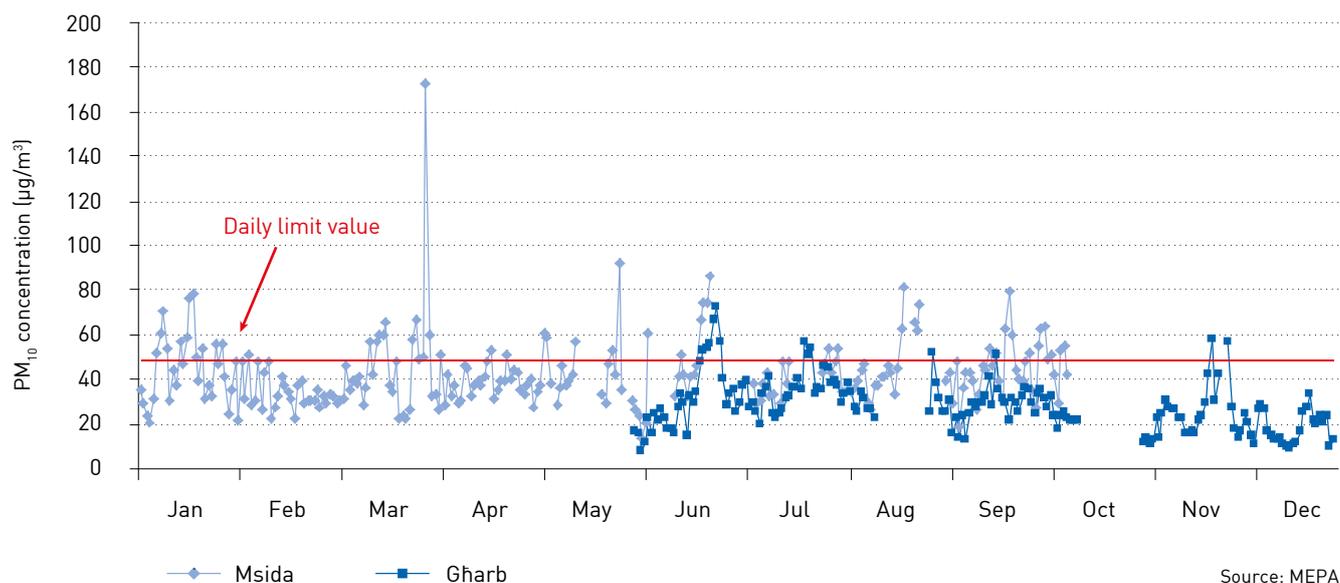


Chart 2.2: PM₁₀ concentrations at Msida and Gharb in 2007



Volatile Organic Compounds (VOCs) cause respiratory irritations and genetic and nervous disorders, depending on various factors including exposure. Certain VOCs such as benzene are carcinogenic and mutagenic.⁶⁷ VOCs are also ozone precursors.⁶⁸ These compounds are generated through combustion,⁶⁹ but also by household products including paints, varnishes, cleansers, disinfectants and automotive products.⁷⁰ The Malta Environment and Planning Authority (MEPA) is monitoring Benzene, Toluene, Ethylbenzene and Xylene, known as BTEX, using diffusion tubes, as well as in near real-time at Msida, Żejtun and Gharb.

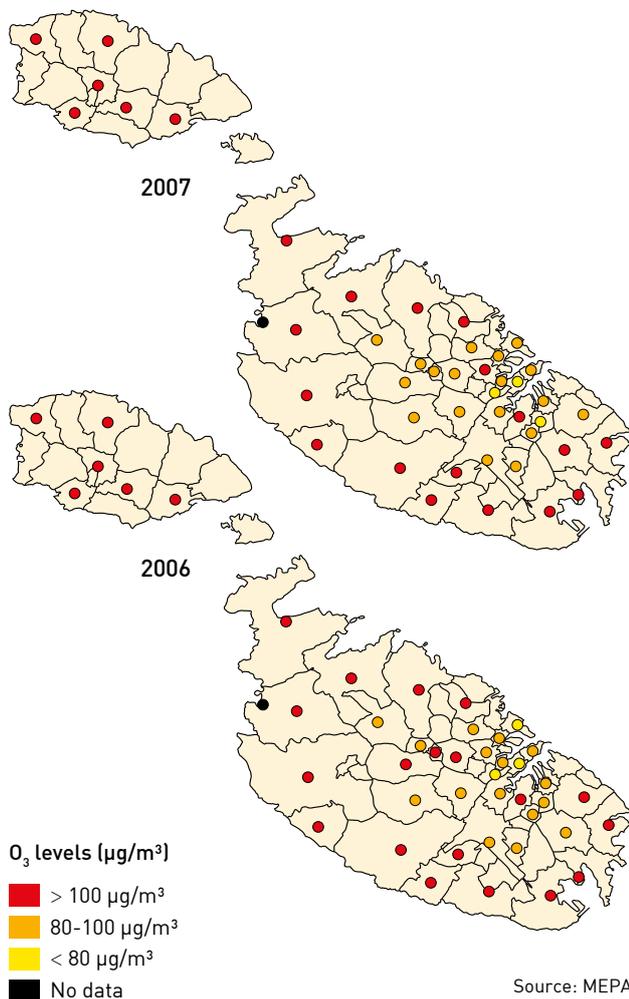
Benzene, a VOC of major concern, is released from petrol fumes and

combustion. **National benzene levels continued to fall in 2007**, in line with the trend since 2000, **due to use of cleaner fuels.**⁷¹ The national benzene annual average decreased by 10.4 percent between 2006 and 2007, to 2.4µg/m³. No locality average exceeded the EU limit value of 5µg/m³ (which is not to be exceeded by 2010), and the lowest benzene concentration in 2007 was recorded in Marsalforn (1.1µg/m³). The largest benzene decreases were recorded in Qrendi (a decrease of 33 percent). In terms of particular sites, as for 2005 and 2006, the highest benzene concentration in 2006 was recorded in St. Anne's Street, Floriana, which nevertheless decreased by nine percent, from 7.1µg/m³ to 6.5µg/m³ in 2007. No other site exceeded the EU limit in 2007, in contrast with 2006, when five sites exceeded the EU limit value.

Annual average ambient concentrations of the solvent toluene decreased slightly from 16.56µg/m³ in 2006, to 15.7µg/m³ in 2007. There are no recommended limits for ambient toluene concentrations, although a 19,100 µg/m³ limit exists for workplace exposure.⁷² No recommended limits are available for ethylbenzene and xylene. The annual ambient concentration of ethylbenzene in 2007 was 3.2µg/m³, compared to 2.9µg/m³ in 2006, while annual ambient concentrations of mp-xylene and o-xylene were 9.4 µg/m³ and 3.6µg/m³ respectively in 2007.

Ozone (O₃) provides an important stratospheric chemical shield, known as the ozone layer, against harmful solar ultraviolet radiation.⁷³ At ground level, however, O₃ is a harmful pollutant that acts on respiratory systems, and potentially causes death from respiratory and heart diseases. It also reduces crop yields.⁷⁴ O₃ is formed when nitrogen oxides and volatile organic compounds react in sunlight, indicating Malta's climatic susceptibility to O₃ pollution. **Ozone is formed through chemical reactions of primary traffic and power generation emissions. However the majority of O₃ affecting Malta is of transboundary origin.**⁷⁵

Map 2.2: Annual average O₃ concentrations by locality



EU standards for O₃ provide the following limit values: 120µg/m³ 8-hourly running average value for human health protection not to be exceeded more than 25 times per year; and also 180µg/m³ hourly information threshold for human health protection.

Although EU limit values have not been set for annual average O₃ concentrations, it is useful to note that national annual average O₃ concentrations decreased slightly by one percent, from 102.3µg/m³ to 101.3µg/m³, between 2006 and 2007. Annual O₃ levels were highest in rural localities less affected by traffic, with Gharb registering the highest levels (125.4µg/m³), followed by Qrendi, Marsalforn and Mgarr (123.9µg/m³, 123.8µg/m³ and 121.2µg/m³ respectively). The reason for this is that the nitrogen monoxide present in high concentration levels in traffic-prone areas reacts with O₃ to form NO₂, thus reducing O₃ concentrations. With respect to individual sites, readings from Triq ix-Xwejni in Marsalforn and Burma Road in Swieqi registered the highest levels of ozone in 2007 (143.4µg/m³ and 141.5µg/m³ respectively). The number of sites with an annual average concentration exceeding 100µg/m³ increased from 25 sites in 2005, to 74 in 2006, remaining constant at 74 sites in 2007.

As in 2006, **ozone concentrations exceeded EU standards in certain areas.** With respect to real-time measurements in 2007, while in Gharb the 120µg/m³ eight-hour average limit value, not to be exceeded more than 25 times per year (or 6.8 percent of days measured), was exceeded in 17.5 percent of days measured, exceedences were recorded in 0.3 percent of days measured in Msida, 5.7 percent of days measured in Żejtun and 2.3 percent of days measured in Kordin. The 180µg/m³ hourly limit was exceeded once in Żejtun and four times in Gharb, with the highest value of 203.4µg/m³ recorded in July in Gharb.

Since Malta's EU accession, imports and exports of Ozone Depleting Substances (ODSs)⁷⁶ have been regulated at EU level.⁷⁷ The placing on the market, use and importation of chlorofluorocarbons (CFCs) is banned, while hydrochlorofluorocarbons (HCFCs) have to be phased out by December 2009. In 2006, Malta's ODS committee reviewed existing legislation in the light of recent EU-derived legal instruments.⁷⁸ Raw stocks of ODSs and hydrofluorocarbons held at customs and in storage were recorded and importers issued import licenses for HCFCs, to replace the damaging CFCs. Furthermore since 2006 several users have shifted from utilisation of HCFCs to the utilisation of hydrofluorocarbons (HFCs), which are less harmful to the ozone layer, although they are greenhouse gases.⁷⁹

Heavy metals such as mercury, arsenic, cadmium and nickel, together with Polycyclic Aromatic Hydrocarbons (PAHs) are also toxins of concern. Arsenic, cadmium, nickel and some PAHs are human genotoxic carcinogens such that there is no identifiable threshold below which these substances do not pose a risk.⁸⁰ While arsenic, cadmium and nickel are emitted from the combustion of fossil fuels and waste, PAHs are emitted through

incomplete fuel combustion, and other industrial and waste-related sources.⁸¹ Since November 2006, Malta has begun to monitor these pollutants in line with legal obligations.⁸² Although initial results do not provide a firm enough basis for decision-making, as the number of samples taken was limited and insufficient for comparison with annual limit values, for which daily samples taken over an extended period are required, it is possible to report broad conclusions. Results indicate that none of the daily samples contained levels of arsenic⁸³ and cadmium above the detection limits [4.5 nanograms per cubic metre [ng/m³] for arsenic and 0.9ng/m³ for cadmium].⁸⁴ However nickel was present in almost all the samples analysed, although the daily concentrations never reached the annual limit value of 20ng/m³. The highest daily average concentration of nickel (18ng/m³) was recorded at Msida.⁸⁵ Daily average concentrations of gaseous mercury were between 1.9ng/m³ during the summer of 2006 and 0.6ng/m³ in the beginning of 2007, which are relatively low in comparison with other Mediterranean countries.⁸⁶ It is likely that mercury contamination is mostly of transboundary origin, deriving from both anthropogenic and natural sources.⁸⁷ Preliminary data is also available for lead: samples were taken over a two-year period from early 2007 to early 2009, and indicate that concentrations are well below the 500ng/m³ EU limit value. Additional results related to metals are available for the period between February 2007 and April 2009. These indicate that only nickel at Kordin exceeded the lower assessment threshold of 10ng/m³ (at 10.7ng/m³). All other metals were below this threshold at the sites tested. Furthermore, initial experimental results collected using a low-volume sampler over a two-week period in 2007 and 2008, and thus considered a two-week average, indicate that Malta's PAH concentrations do not exceed the EU limit value of 1ng/m³, although compared to other stations higher levels of the main proxy indicator for PAHs, Benzo(a)pyrene, were recorded at Msida (0.46ng/m³).

Measures have been taken in various sectors in response to these concerns. In the environment sector, by 2006, in addition to Malta's diffusion tube network covering 44 localities,⁸⁸ four real-time fixed stations were operational at Floriana, Kordin, Żejtun and Msida. An additional background station came online in Gozo in 2007. Real-time air monitoring data on the major pollutants are viewable online,⁸⁹ while hourly ozone data are being captured and transferred to the EU OzoneWeb.⁹⁰ Malta has also developed a national emissions inventory in line with the NEC Directive.⁹¹ In line with its obligations Malta is also drawing up plans and programmes to reduce pollutant levels, and public consultation has been under way during 2009 in this respect.

In the energy sector, while measures such as financial incentives have been taken to promote energy conservation and use of renewable energy sources,⁹² additional measures will be required for Malta to reach the NEC Directive targets for 2010 related to SO₂ and NO_x. These will include the commissioning of a new 100MW power generation plant at Delimara, modification of the Delimara Power Station⁹³ to comply with the Large Combustion Plants Directive,⁹⁴ and the decommissioning of the Marsa power station by 2015.⁹⁵ Furthermore, in 2006 Government decided in favour of a cable interconnection with Sicily to supplement on-island generation.

The principal transport-related measures undertaken in the review period relate to the 2005 'Emissions Alert SMS' project, the 2006/7 Valletta Strategy, which aims at reducing traffic-generated air pollution in the peninsula, as well as various fiscal incentives.⁹⁶ The principal tool to control industrial emissions from major sources is the Integrated Pollution Prevention and Control (IPPC) permit, whereby operations will need to implement permit conditions related to emissions.⁹⁷ The environmental permitting system, in cooperation with a grant scheme for enterprises, should improve the performance of smaller enterprises. This brief review indicates that **a number of measures have been taken to address air pollution. Further improvements in air quality will be achieved through accelerating the introduction of more environmentally-friendly transport systems and the use of cleaner and alternative energy sources.**





CHAPTER 3

CLIMATE CHANGE

KEY MESSAGES:

- » Malta's greenhouse gas emissions increased by 49 percent between 1990 and 2007, and derive largely from the energy (including transport) and waste sectors.
- » In order to address the uncertainties associated with the impacts of climate change in Malta, studies based on climate projections and national impact scenarios relating to the Islands are required, particularly since Malta's small-island characteristics make it especially vulnerable to the effects of climate change, sea-level rise and extreme events.
- » There is a need to sustain efforts towards decoupling of economic activity from greenhouse gas emissions. In this respect, it is important to initiate both supply-side measures, such as investing in a range of cleaner and more efficient energy technologies, including renewables and high-efficiency cogeneration, as well as demand management measures. These would include measures such as energy efficiency in buildings, and in the transport sector.
- » Climate change adaptation needs to be addressed through the development of a wide-ranging adaptation plan that addresses actions across sectors as diverse as land-use, health and tourism, as well as impacts across a range of social groups.
- » Climate change measures will need to be mainstreamed across all policy sectors, so that sectoral policies are assessed for their impacts on climate change and their effects on vulnerability, but also to plan for climate change adaptation through increased resilience.
- » The important role of development planning as a tool for mitigating and adapting to climate change needs to be recognised further. In this respect, mitigation and adaptation measures will need to be integrated within development plans and related subsidiary policies and regulations.

Climate Change is currently one of the principal threats being faced by nations worldwide, although the impacts of climate change will differ among them depending on their relative vulnerabilities. Human activities such as the combustion of fossil fuels and deforestation have from the start of the industrial revolution led to higher concentrations of carbon dioxide and other greenhouse gases (GHGs) in the atmosphere. GHGs trap heat within the atmosphere, resulting in a general increase in global temperatures, with associated changes in climatic and physical conditions. Indeed, the temperature in Europe is currently 1.4°C warmer than pre-industrial levels.⁹⁸ In order to address climate change, both mitigation and adaptation measures will be necessary. The anthropogenic cause of climate change, GHG emissions, will need to be controlled, in tandem with addressing the damage experienced to date, and taking measures to adapt to climate change. This chapter provides an introduction to climate change, detailing the policy context, the status of Malta's climate and national GHG emissions. It closes by discussing climate change mitigation and adaptation.

Malta is party to the 1992 United Nations Framework Convention on Climate Change (UNFCCC),⁹⁹ and has also signed its 1997 Kyoto Protocol. While Malta does not have a GHG reduction target under the UNFCCC, since at the time of signing, the Islands were considered a developing country,¹⁰⁰ as an EU member state, Malta has transposed all the EU measures and policies related to climate change. The overall EU climate change target is to limit the rise in global surface mean temperature to less than 2°C compared to pre-industrial levels, this being the threshold beyond which there is a significant risk of irreversible damage occurring.¹⁰¹ Under its 2000 European Climate Change Programme,¹⁰² the EU has developed a range of policies and measures to reduce GHG emissions, including an Emissions Trading Scheme (ETS),¹⁰³ the June 2007 Green Paper,¹⁰⁴ and subsequent 2009 White Paper¹⁰⁵ on adaptation to climate change, the January 2007 Energy Policy for Europe,¹⁰⁶ and the November 2007 Strategic Energy Technology Plan.¹⁰⁷ In March 2007, the European Council agreed the following integrated energy and climate policy targets to be reached by 2020:¹⁰⁸

- » Cutting GHG emissions by 20 percent (30 percent if international agreement is reached) compared to 1990 levels;
- » Having 20 percent of energy consumption through increased energy efficiency;
- » Meeting 20 percent of EU energy needs from renewable energy sources (RES).

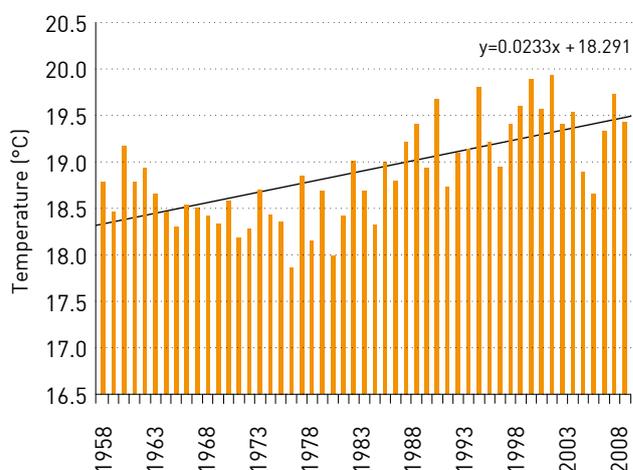
In order to implement this political agreement, in early 2008¹⁰⁹ the European Commission put forward a package of Climate-Energy measures, which was approved in December 2008, and covers four pillars: a general review of the EU ETS Directive;¹¹⁰ a proposal on the efforts by Member States to reduce their GHG emissions in non-ETS

areas;¹¹¹ a proposed new directive on RES;¹¹² and, a proposed Directive to promote the development and safe use of carbon capture and storage technology.¹¹³ Malta has taken on board these commitments.

Based on current knowledge, Malta's climate is undergoing gradual change, becoming slightly drier and warmer, in line with regional predictions. Nevertheless, to have a better understanding of how climate change is affecting Malta,¹¹⁴ data covering longer time periods is required, since climatic changes may be linked to other processes besides human-induced climate change.

Temperature rise is one of the principal predicted impacts of climate change in Malta. Mean annual air temperature has risen by 0.23°C per decade over the past 50 years (Chart 3.1). Climate-induced temperature rise is expected to lead to drought, desertification and associated soil erosion, and have implications on various sectors, including health, tourism, biodiversity and energy. In the health sector, an increase in vector- and food-borne diseases is expected, together with a projected incidence of thermal stress-related illnesses.¹¹⁵ The increase in temperature may also cause a shift in preferred tourist destinations.

Chart 3.1: Mean annual temperature



Source: NSO

Changing precipitation patterns are predicted to be another key impact of climate change at a European level,¹¹⁶ and a decrease of between 10 and 40 percent in mean annual precipitation is expected in Southern Europe by 2100.¹¹⁷ Despite cyclical patterns, Malta's precipitation data indicates a trend towards a decrease of 7.9mm per decade between 1958 and 2008. The number of thunderstorms also decreased by 0.8 per decade over the last 30 years.¹¹⁸ The decrease in precipitation is expected to have a number of implications, including, in the longer term, greater reliance on desalination for fresh water production, and increased pollution of groundwater bodies due to concentration



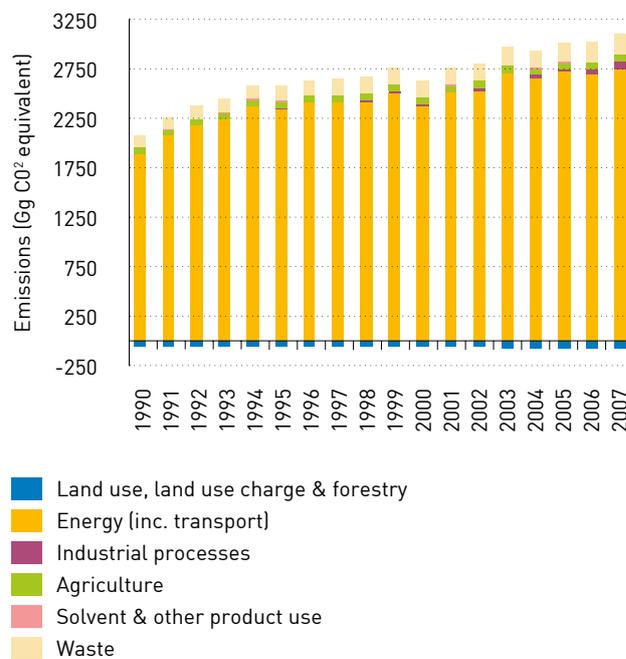
of pollutants, as well as impacts on biodiversity, which will be affected by the reduced freshwater availability and quality.¹¹⁹ Climate change is also expected to result in greater climate variability, with shorter rainy seasons and briefer but higher-intensity storms, so that climate change impacts are felt more intensely through extremes such as droughts and floods.¹²⁰ In the last decade the Islands experienced two of the most severe droughts since 1960, in 2000-2001 and 2001-2002.¹²¹

While sea-level rise is one of the predicted effects of climate change, trends in the Mediterranean have been found to be anomalous.¹²² In view of limited understanding of some important effects driving sea-level rise,¹²³ there is a need for more Mediterranean-wide data covering long time series, before it can be determined how sea levels will change. Nonetheless, national statistics indicate that Malta's mean sea level has risen by 19.5cm between 1946 and 2007.¹²⁴ The general impacts associated with sea-level rise include coastal inundation and increased rates of coastal erosion.¹²⁵

Overall, based on UN benchmarks, Malta is expected to suffer moderate impacts from climate change, mainly related to: drought; deterioration of freshwater quality and availability; increased risk of floods; soil and coastal erosion; desertification; changes in sea level; and, biodiversity loss and degradation. These impacts are expected to have an effect on health, agriculture and fisheries. Malta's dependence on coastal activities also means that its economic vulnerability is expected to be moderate to moderately high.¹²⁶ **In order to address the uncertainties associated with climate change impacts in Malta, studies based on climate projections and national impact scenarios are required, particularly since Malta's small island characteristics make it especially vulnerable to the effects of climate change, sea-level rise and extreme events.**¹²⁷ Indeed, Malta will need to adapt to climate change impacts to ensure sustainable development and economic growth within a changing climatic regime.

Despite its vulnerability to climate change, Malta's GHG emissions are low due to the nation's size in geographic, demographic and economic terms.¹²⁸ Nevertheless, **Malta's GHG emissions increased by 49 percent between 1990 and 2007** (Chart 3.2). The flattening observed in the chart may be due to the switch from coal for energy generation. **The energy sector¹²⁹ was the principal contributor** to Malta's GHG emissions in 2007 (89 percent¹³⁰ of total emissions in 2007). **The second most significant contributor was the waste sector** (6.6 percent of overall emissions),¹³¹ followed by agriculture and industrial processes, which together contributed approximately two percent¹³² of total emissions in 2007. The category Land Use, Land-Use Change and Forestry (LUFLUF) indicates estimates of carbon dioxide emissions and removals by particular vegetation types, and is estimated to contribute a removal of two percent of Malta's emissions.¹³³

Chart 3.2: Total greenhouse gas emissions per sector



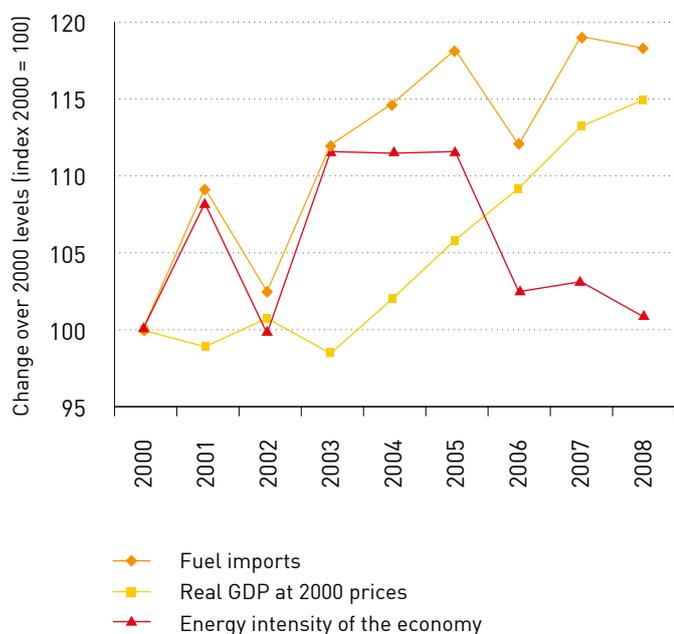
Source: MEPA

In terms of emissions per unit GDP (in billion Euros at 2000 prices), there was an overall decrease of 18 percent between 1990 and 2007, possibly reflecting a degree of decoupling of emissions from economic development over the whole time period, although there are significant fluctuations when comparing shorter time ranges.¹³⁴ With respect to per capita emissions, at 7.25 tonnes per capita, these grew by 33 percent in this period, although this trend seems to be stabilising over recent years. Despite this increase, Malta still had a relatively low GHG emission rate per capita in 2006 when compared to the EU-27 average (10.4 tonnes per capita).¹³⁵

National sectoral projections with respect to GHG emissions in the years 2010, 2015 and 2020 have now been prepared on the basis of existing and planned measures.¹³⁶ These measures are detailed below in the section on mitigation. In the energy sector (including transport), emissions are projected to decrease from 2,696Gg CO₂e in 2007 to 1,936Gg CO₂e in 2020 on the basis of existing measures, while with additional measures, a decrease to 1,782Gg CO₂e is expected. In the industrial processes sector, emissions are projected to increase from 69 to 70Gg CO₂e over the same period. A decrease from 74 to 69Gg CO₂e, and an increase from 170 to 279Gg CO₂e for this period are expected in the agriculture and waste sectors respectively.

Since the energy sector is the main driver of GHG emissions in Malta, it is worth investigating the energy intensity of the Maltese economy, which is a measure of the energy Malta uses to create a unit of GDP. Energy intensity is calculated on the basis of a ratio between total energy produced and GDP.¹³⁷ Total energy produced in the Maltese Islands can be estimated using net fossil fuel import values.¹³⁸ The overall trend since 2000 has been for the energy intensity of the economy to decrease slightly; should this trend continue it may point towards a shift towards a relative¹³⁹ decoupling of energy consumption from economic activity. These figures point to the need to absolutely decouple economic activity from energy use.

Chart 3.3: Fuel imports, GDP at 2000 prices and energy intensity of the economy as a percentage of base year 2000



Source: NSO; NSO 2006; 2008g; 2009b

Responses to climate change address either mitigation or adaptation, although mitigation measures currently exceed those related to adaptation. In the area of mitigation, a raft of policies and measures have been initiated at a global, EU and national level. As an EU Member State, Malta is obliged to take on board all Community legislation that could result in the reduction or limitation of greenhouse gas emissions, including the EU ETS,¹⁴⁰ through which Member States determine respective caps for emissions of GHGs from relevant installations in their territory.¹⁴¹ For the period 2008 to 2012 Malta proposed an allocation of 14.8 million tonnes of CO₂e,¹⁴² but this was later revised to 10.7 million tonnes of CO₂ following a decision of the European Commission. In the context of the Clean Development Mechanism (CDM)¹⁴³ under the Kyoto Protocol, WasteServ (Malta) Ltd has proposed to extract and use landfill gas from Ta' Żwejra, delivering annual emissions savings of 19,000 tons of CO₂e. The project is at validation stage and is pending registration with the CDM Executive Board.

At a national level, there has been much activity at the policy level regarding the promotion of energy efficiency and RES: draft Renewable Energy¹⁴⁴ and National Energy¹⁴⁵ policies were published in 2006, while a National Energy Efficiency Action Plan¹⁴⁶ and a revised draft Energy Policy for Malta¹⁴⁷ were published in 2008 and 2009 respectively. A Climate Change Committee also issued its consultation report in January 2009.¹⁴⁸ The 2008 EU climate-energy package¹⁴⁹ envisages a substantial increase in the use of RES for Malta by 2020.¹⁵⁰ In order to achieve this, Malta will need to invest in research and development, as well as commissioning a range of renewable energy technologies. The draft RES policy¹⁵¹ identifies wind energy as one of the most cost-effective solutions, and as of end 2008, Government was assessing the viability of both onshore and offshore wind farms.



Table 3.1: Policies and measures considered most effective in reducing GHG emissions (December 2008)

Measure Number	Description	Measure type	Status
Energy Supply			
1	Plant loading and fuel switching	Technical	Implemented
2	Installation of new and efficient generating capacity (100MW at Delimara Power Station) to partly replace existing inefficient plant at Marsa Power Station	Technical	Adopted
3	Submarine electrical interconnection to European network (200MW underwater cable) to further replace generating capacity at Marsa Power Station.	Technical	Adopted
4	Future installation of further new and efficient generating capacity	Technical	Planned
Energy Demand and RES			
5	Energy Performance in Buildings Regulations	Regulatory	Implemented
6	Intelligent metering and demand side reduction measures	Economic	Implemented
7	Energy-efficiency measures in street lighting	Technical	Adopted
8	ERDF Energy grant scheme for industry	Economic	Implemented
9	Rebates on energy-efficient domestic appliances	Economic	Expired
10	Promotion of solar water heaters	Economic	Implemented
11	Grants on the purchase of micro RES generation equipment	Economic	Implemented
12	Distribution of energy-saving lamps in the domestic sector	Economic	Adopted
13	Energy saving measures in water production and distribution	Technical	Implemented
14	Energy saving and RES measures in state schools	Voluntary	Implemented
15	Energy saving measures in Social Housing	Voluntary	Implemented
16	Information campaign on energy efficiency	Information	Implemented
17	Installation of steam recovery turbine at Marsa Thermal Treatment Facility	Technical	Implemented
18	Installation of photovoltaic and wind turbine technologies at Waste facilities	Education; Research	Planned
Waste			
19	Aerial emissions works at closed landfill sites	Regulatory, economic	Implemented
20	Gas management at Ta' Żwejra and Ghallis Non-hazardous landfills	Regulatory, economic	Implemented
21	Sant' Antnin Biological Treatment Plant	Regulatory, economic	Implemented
22	Biogas from urban waste water treatment	economic	Implemented
Land Use, Land Use Change and Forestry			
23	Afforestation Projects	Voluntary, Planning, Education	Implemented
Cross-cutting			
24	Policy on national research	Research	Implemented

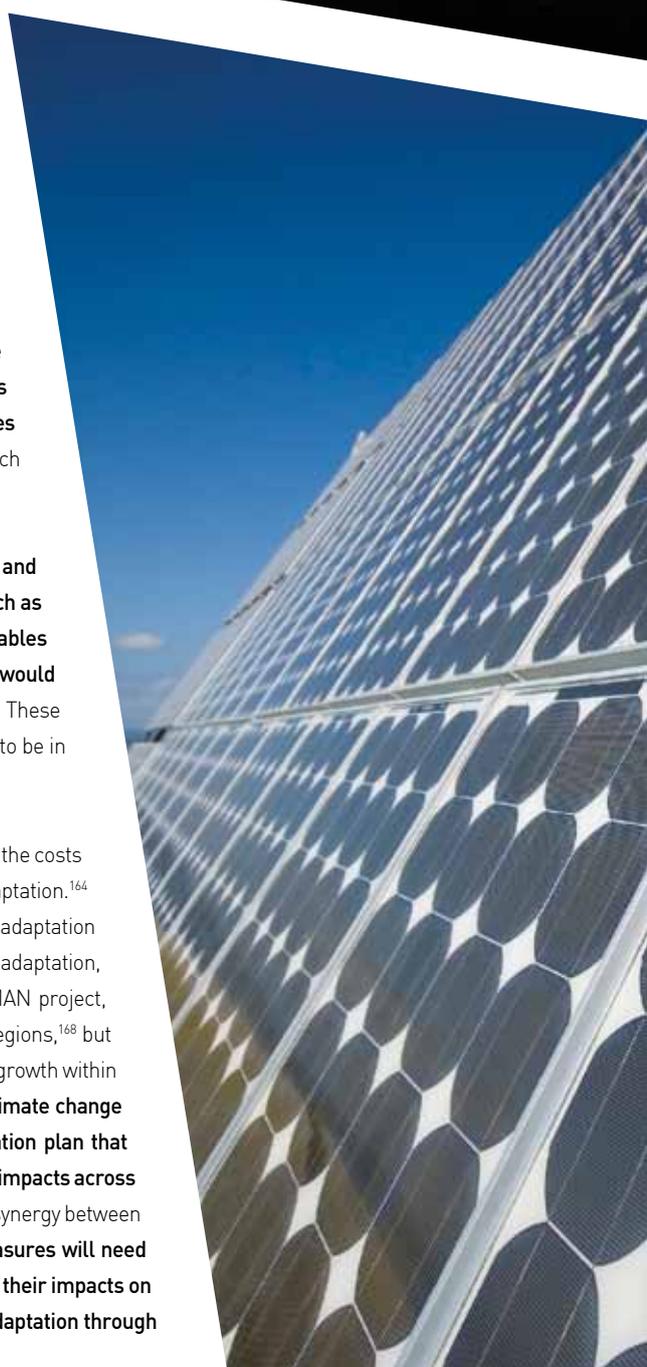
Source: MEPA 2009b

The principal climate change mitigation measures are documented in Malta's biennial programme and measures report (Table 3.1).¹⁵² They originate from a number of sectors, including energy, waste and land use, and make use of various mechanisms such as technical, regulatory, economic, voluntary and informational instruments. In the energy sector, four technical measures address energy supply,¹⁵³ while a mix of economic, technical, regulatory and information/education/research tools address energy demand and RES. The energy demand and RES measures have targeted a number of sectors: while economic instruments have been used in the residential¹⁵⁴ and industrial¹⁵⁵ sectors, voluntary measures have been taken in state schools and social housing, and technical¹⁵⁶ and educational¹⁵⁷ measures have been used at waste management facilities. The informational¹⁵⁸ and regulatory measures¹⁵⁹ did not target any particular sector.

Various measures are in the pipeline for the transport sector,¹⁶⁰ while four regulatory and economic measures in the waste sector mainly target emissions and RES.¹⁶¹ In the land use sector, afforestation projects should increase Malta's area covered by permanent vegetation, while MEPA guidance¹⁶² encourages energy conservation measures and the possibility of energy audits for major projects. However, **the important role of development planning as a tool for mitigating and adapting to climate change needs to be recognised further. In this respect, mitigation and adaptation measures will need to be integrated within development plans and related subsidiary policies and regulations.** Meanwhile energy and environment have become national research priorities,¹⁶³ while the University of Malta has developed a capacity in climate modelling.

There is still need, however, to sustain efforts towards decoupling of economic activity and GHG emissions. In this context, **it is important to initiate both supply-side measures, such as investing in a range of cleaner and more efficient energy technologies, including renewables and high-efficiency cogeneration, as well as demand management measures. These would include measures such as energy efficiency in buildings, and in the transport sector.** These mitigation efforts, which are being carried out in the absence of specific scenarios, need to be in line with sustainability.

There is also need for national adaptation measures, as it increasingly becomes clear that the costs of non-adaptation to climate change will be higher than those likely to be incurred for adaptation.¹⁶⁴ These measures will need to be in line with the UN Bali Action Plan,¹⁶⁵ and emerging EU adaptation policy.¹⁶⁶ To date there have been some national initiatives relevant to climate change adaptation, such as the measures developed to implement EU water policy,¹⁶⁷ and the INWATERMAN project, which addresses the sustainable use of water resources in arid and semi-arid insular regions,¹⁶⁸ but no direct adaptation measures. In order to ensure sustainability and continued economic growth within a changing climatic regime, therefore, **it is important that the national committee on climate change adaptation addresses this matter through the development of a wide-ranging adaptation plan that addresses actions across sectors as diverse as land-use, health and tourism, as well as impacts across a range of social groups.** This strategy will need to ensure cross-sectoral coherence and synergy between mitigation and adaptation actions, in order to avoid maladaptation. **Climate change measures will need to be mainstreamed across all policy sectors, so that sectoral policies are assessed for their impacts on climate change and their effects on vulnerability, but also to plan for climate change adaptation through increasing resilience.**





CHAPTER 4

LAND

KEY MESSAGES:

- » There is significant potential for improving the overall efficiency of land use, particularly given current over-supply in the residential, commercial and industrial sectors. The potential of using incentives to achieve this merits investigation.
- » While tall buildings may increase the efficiency of land use, their impact on the Maltese landscape is becoming a matter of concern.
- » The rural environment remains largely dominated by agriculture, which has an important stewardship role in ensuring countryside quality. However it faces various threats such as land abandonment, loss of rubble walls, dumping, agricultural land reclamation, blocking of countryside access and the inappropriate design of rural buildings. The cumulative effect of development in rural areas should be closely monitored and further efforts made for it to be strictly contained. The Rural Development Plan's agri-environmental measures exploit the synergies between agriculture and environment and should be sustained and resourced in the future. A high quality rural environment has a major role in improving quality of life.
- » Many historical buildings and areas have been given statutory protection, and as of mid-2008, 62 Urban Conservation Areas had been designated, whilst more funds have been directed towards the restoration and management of heritage sites. Despite these efforts, heritage remains under threat from factors such as inappropriate design of new and restored buildings, which undermines street character, and demolition. Much conservation effort remains limited to Urban Conservation Areas, which face increasing tensions at their fringes. If not scheduled, buildings of historical value outside Urban Conservation Areas remain unprotected and archaeology remains threatened. More resources need to be allocated to the scheduling process.
- » Malta's soil resources are important for the maintenance of ecosystem health, agriculture and hydrological processes. However soils are threatened by a range of factors including contamination, soil sealing and erosion. There is a need for Malta to update national legislation and build capacity in this area for monitoring and enforcement.

Land is one of Malta's most important environmental media, providing the physical context for the ecological systems that support biodiversity and human life itself. Social and cultural activities use land as a backdrop, and it is a fundamental economic resource. Due to Malta's small size, high population density and rich island biodiversity, decisions relating to land-use change are often highly contested. In what follows, this chapter examines current trends relating to land cover, rural and urban areas, cultural heritage, geology and soil.

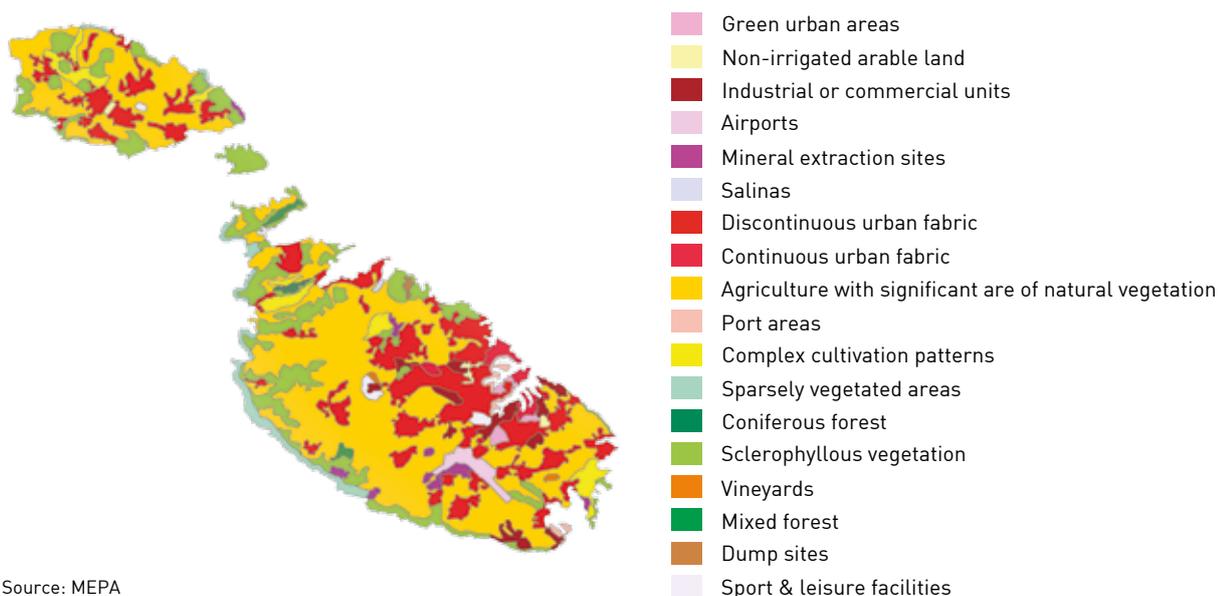
Malta's 2006 CORINE¹⁶⁹ land cover map (Map 4.1)¹⁷⁰ indicates that agriculture remains the Islands' predominant land cover (51 percent of land area), followed by urban areas (22.3 percent) and natural vegetation¹⁷¹ (19.1 percent). During the review period, the 11,000ha temporary provision schemes¹⁷² were increased by 2.3 percent, such that the development zone was extended, mostly in areas bordering on the previous scheme boundary or already committed by previous development. Despite the Islands' high population density, 22 percent of all dwellings¹⁷³ were permanently vacant in 2005 and five percent were second homes.¹⁷⁴ Similar over-supply has been observed in the commercial and industrial sectors,¹⁷⁵ suggesting that there is significant potential for improving the overall efficiency of land use. The potential of using incentives to achieve this merits investigation.

Occupying 70 percent of land area, Malta's countryside provides life-supporting ecosystem services such as clean air, soil, and waters. It is also the physical backdrop to Malta's national heritage, as well as cultural, recreational and economic activities, contributing significantly to quality of life. However due to Malta's small size and dense land use, countryside areas are exposed to various, often conflicting, anthropogenic pressures, principally related to agriculture and land development.

The rural environment remains largely dominated by agriculture, which has an important stewardship role in ensuring countryside quality. Agriculture¹⁷⁶ has a mixed legacy with respect to the environment, as it maintains rural landscapes yet sometimes introduces unsightly structures and polluting activities.¹⁷⁷ The latter chiefly occurs when farming becomes intensified through increased use of agricultural chemicals, animal farms and greenhouses. Other agriculture-related threats to rural areas include land abandonment, loss of rubble walls, dumping, agricultural land reclamation, blocking of countryside access, and the inappropriate design of rural buildings.

Most rural land development permitted relates to agriculture,¹⁷⁸ dwellings (although these only averaged 3 percent of total dwelling permissions between 2000 and 2008),¹⁷⁹ quarries, access routes (including roads and paths), boundary walls and additions to already-existing

Map 4.1: Land cover by type (2006)



Source: MEPA



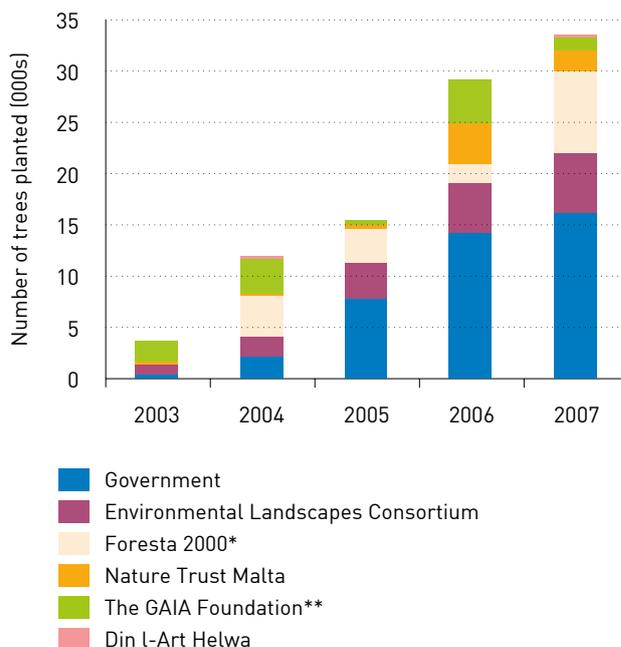
developments. In terms of land-take, major social and community developments¹⁸⁰ have had an impact over the review period, due to their envisaged land requirements. These developments also give rise to light pollution, which deserves increased policy attention. **The cumulative effect of development in rural areas should be closely monitored and further efforts made for it to be strictly contained.**

A number of measures are in place to mitigate these impacts, including rural development policy, organic farming, afforestation projects, quarry restoration, and protective designations, together with funding programmes such as MEPA's Environmental Initiative Partnership Programme (EIPP). Rural development policy¹⁸¹ exploits the synergies between agriculture and environment and involves the use of a Code of Good Agricultural Practice¹⁸² and agri-environmental schemes to improve the environmental performance of the agricultural sector. While targets related to the three agri-environmental measures were not met in the first rural development plan,¹⁸³ valuable experience was gained, and the 2007-2013 Rural Development Strategy¹⁸⁴ added new measures to reduce pesticide and herbicide use, encourage crop rotation, apiculture and use of conservation buffer strips, and conserve traditional rural structures. **Due to their exploitation of the synergies between agriculture and environment, these measures should be sustained and resourced in the future.** MEPA published planning guidance¹⁸⁵ in 2007 to guide agricultural development in line with rural development policy. One key agri-environment measure concerns organic farming.

By end 2008 there were 14 registered Maltese operators of organic¹⁸⁶ products, cultivating 21.78ha,¹⁸⁷ increasing from 17.3ha in 2007.¹⁸⁸ Nevertheless, Malta retains a very low share of organic agriculture in total production (0.19 percent of total agricultural land, and 0.21 percent of Utilised Agricultural Area). A number of structures have been established to address this shortfall including a legal framework, a certification body (Malta Standards Authority [MSA]), a national organic agriculture strategy¹⁸⁹ and financial

support.¹⁹⁰ Afforestation projects also contribute to a quality rural environment. Trees planted increased rapidly between 2003 and 2007 (Chart 4.1), rising by approximately 14 percent between 2006 and 2007, when 33,278 trees were planted. Some afforestation projects have adopted an ecosystem approach whereby the restoration of the entire habitat type is the project objective.¹⁹¹

Chart 4.1: Trees planted



* Foresta 2000 is a joint Birdlife Malta, Din l-Art Helwa and the PARC Department (MRRRA) venture.
 ** 2007 figures exclude 300 trees that were planted for the Foresta 2000 project.
 Source: MRRRA, Din l-Art Helwa, Nature Trust (Malta), The GAIA Foundation and Birdlife (Malta)

Due to the unsightliness of mineral extraction sites, there has been a drive in recent years towards quarry restoration. In line with Malta's waste strategy,¹⁹² by end 2008 14 permits had been granted since 2003 for inert waste disposal in disused quarries.¹⁹³ There have also been development permissions issued for restoration of quarries to arable agricultural, livestock breeding, industrial, or domestic usage. Future use of spent quarries could extend to biodiversity and geo-diversity conservation, in line with international good practice.¹⁹⁴ The protective designations most common in rural areas are scheduling of areas of ecological and scientific importance, and Areas of High Landscape Value.¹⁹⁵ As of end 2008, approximately 20.5 percent of land area had some form of protective legislation, while total area designated for landscape value constituted 33 percent of land area by end 2008.¹⁹⁶ Designated area management plans¹⁹⁷ point the way towards a new comprehensive approach to improving countryside quality.

Malta is a highly urbanised society (94 percent urban dwellers in 2007).¹⁹⁸ Typical urban issues related to overcrowding, congestion,

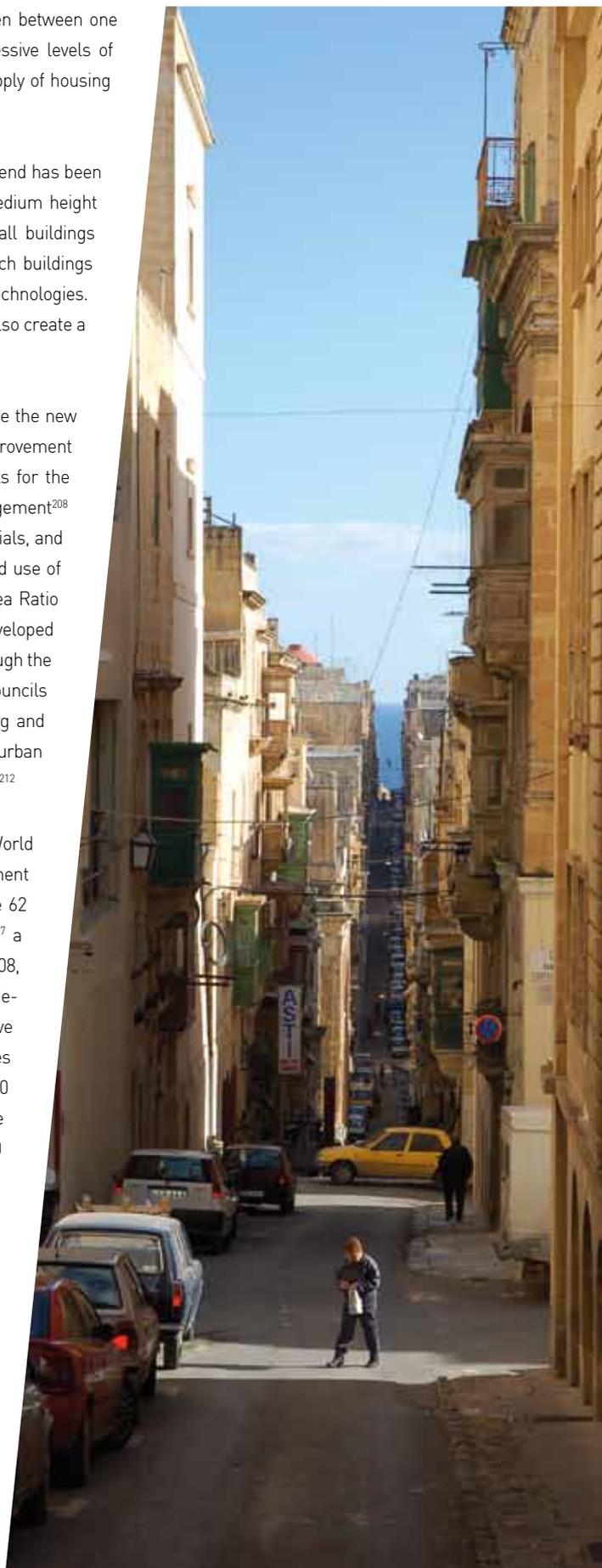
waste and noise, are amplified by Malta's dense urban setting,¹⁹⁹ often unbroken between one settlement and another, high levels of residential vacancy, which lead to excessive levels of abandoned and dilapidated buildings,²⁰⁰ high land prices²⁰¹ in spite of the oversupply of housing stock, and the large number of construction projects.²⁰²

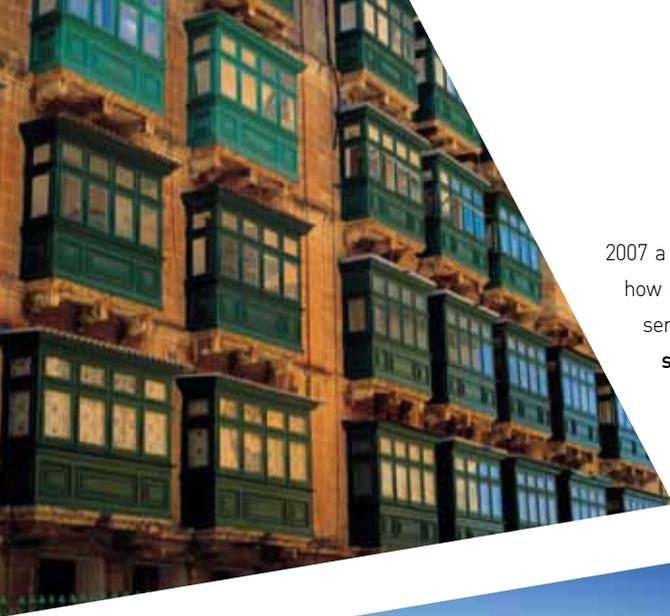
Building densities have increased, following relaxation of building heights. This trend has been accompanied by demand for tall and medium-sized buildings,²⁰³ with 12 tall/medium height buildings permitted as of July 2008,²⁰⁴ and this high demand continues. Yet tall buildings remain controversial, with some commentators²⁰⁵ questioning the impact of such buildings on landscape, coastal settings and potential for use of climate-friendly building technologies. Besides contributing to overcrowding in urban areas, such dense developments also create a higher demand for low-density suburban development.

Positive measures²⁰⁶ taken over the review period to improve urban areas include the new construction regulations, a policy to regulate building heights, MEPA's Urban Improvement Fund (UIF), and Government's 'vision papers' containing regeneration proposals for the Grand Harbour and Marsamxett.²⁰⁷ The 2007 regulations on construction management²⁰⁸ aim to reduce nuisance to neighbours, targeting dust, spillages of building materials, and visual impact. MEPA's draft policy guidance on tall buildings²⁰⁹ sets out preferred use of such buildings, strategic locations, and evaluation criteria, based on a Floor Area Ratio approach.²¹⁰ Practical experience with this tool suggests that it could be further developed to better ensure architectural quality and usable open space at ground level. Through the UIF,²¹¹ which by January 2009 contained €5.5 million, the large majority of local councils have carried out urban embellishments relating to themes such as landscaping and traffic management. Recent years have also seen the embellishment of various urban sites including promenades, historical buildings, public gardens and village cores.²¹²

The Maltese Islands have an exceptionally rich cultural heritage,²¹³ hosting eight World Heritage Sites,²¹⁴ but their high population density and dynamic urban environment continue to pose certain threats to its conservation.²¹⁵ By June 2008 there were 62 Urban Conservation Areas (UCAs) designated,²¹⁶ covering an area of 13.8km²,²¹⁷ a sharp increase over 2005 when only 18 UCAs were fully approved. As of April 2008, streets in the UCAs of 37 localities had been categorised, allowing for a more fine-tuned approach to conservation.²¹⁸ As of December 2008, the National Protective Inventory (NPI)²¹⁹ contained over 12,000, chiefly architectural entries, with 160 sites in Valletta added between 2005 and March 2008. A further 256 sites, including 80 parish churches, 30 archaeological sites and 25 buildings that are listed in the Antiquities List of 1932,²²⁰ 45 windmills, 46 British period fortifications and 30 miscellaneous sites are expected to be included in the near future.

In addition, as of December 2008, 1,904 chiefly architectural sites had been scheduled,²²¹ with 83 percent afforded Grade 1 and Grade 2 protection levels. In 41 of the approximately 1,700 upper tier (ie not Grade C or Class 3) sites protected, the landscape settings is protected by a buffer zone. Three Conservation Orders²²² had also been issued as at December 2008, to protect threatened buildings or features. A spatial database of scheduled items is now available online.²²³ Between 2000 and August 2008, nine percent of notified owners applied for a reconsideration of the scheduling decision, while 1.13 percent lodged an appeal²²⁴ against the scheduling decision with respect to scheduled buildings.²²⁵ Bank guarantees requested to ensure compliance with permit conditions are also sometimes forfeited. Between 2004 and April





2007 a total of 15 percent of such bank guarantees were forfeited, raising questions about how much the guarantees, which as of March 2007 had averaged €4,700, were actually serving as deterrents.²²⁶ Indeed, **there remain a number of concerns regarding the scheduling process.** These include: difficulties with effectively protecting the setting of cultural monuments and buildings;²²⁷ demolition of scheduled buildings and those in UCAs,²²⁸ significant monuments still unprotected, lack of procedural clarification and transparency; shortage of trained staff; lack of enforcement capacity; poor coordination between agencies involved in heritage management; and, lenient court sentences for damage to cultural heritage.

Besides being legally protected, heritage sites need ongoing conservation efforts, yet as of mid-2007 only 0.04 percent of Grade 1 or Class A sites were under full management (86 percent of which were publicly owned), although 28 percent were being used in a way that was contributing to the restoration of the building or site.²²⁹ As the 2005 Report noted, these factors result in loss of historic fabric, exacerbated by inappropriate design of new (and restored) buildings and illegal excavations within archaeologically sensitive sites.²³⁰ The 2005 Report also noted the need for an integrated approach to the regeneration of historic areas, which considers socio-economic issues in historic urban areas in tandem with cultural heritage and environmental ones. The Government-led renewed interest in the regeneration of the Grand Harbour area, affords us with an opportunity to put these theories into practice.²³¹ A number of positive initiatives taken through the planning system promote conservation. These include the MEPA balconies scheme, which by end 2006 had disbursed €351,760 to householders while a new scheme in 2007 allocated €1,031,478, as well as the abovementioned EIPP.

Recent research²³² raises interesting considerations for conservation practice: first, public perceptions of thresholds relating to acceptable loss of cultural, natural and historical features may be different from those of experts, leading to unexpected conflicts in the public sphere. Another lesson concerns the level of support enjoyed by current conservation practice within Government and with the public, suggesting that more needs to be done to communicate what the designation of protected sites means for users, and what it can achieve in practice. This suggests that there are still significant conceptual challenges to be faced in protecting and managing the Islands' heritage at levels that ensure its enjoyment by current and future generations. In summary, while **many historical buildings and areas have been given statutory protection, and more funds have been directed towards the restoration and management of heritage sites, heritage remains under threat from factors such as inappropriate design of new and restored buildings, which undermines street character, and demolition. Much conservation effort remains limited to UCAs, which face increasing tensions at their fringes. While if not scheduled, buildings of historical value outside UCAs remain unprotected and archaeology remains threatened. More resources need to be allocated to the scheduling process.**

Geological and geomorphological conservation is important since geology and geomorphology constitute a record of national and regional history, and have a fundamental role in supporting biodiversity and natural resources such as water, soil and minerals. Sensitivity to geological setting also reduces any geological risks related to land development.²³³ Nevertheless, geological heritage is often threatened by development, including insensitive coastal engineering, landfilling and minerals extraction. To date, 11 of the 64 scheduled Areas of Ecological Importance and Sites of

Scientific Importance have been scheduled for their geological or geomorphological value. The Special Area of Conservation designation process²³⁴ also provides for geological and geomorphological conservation. Positive future conservation directions include the adoption of geologically-sensitive measures within the area management plans, and the sensitive restoration of spent quarries of geological value.

Soil is a primary resource for agriculture, as well as being fundamental for the maintenance of ecosystems and hydrological processes.²³⁵ Malta's increasing urbanisation, together with its intensification of agricultural practices, have accentuated the pressures on soil. **The principal threats to Maltese soils may be described as erosion, soil sealing, decline in organic matter, soil contamination, and salinisation.**²³⁶ Although data on the extent and severity of soil threats and the economic and environmental implications of soil degradation are sparse, monitoring data is available on three key soil quality indicators between 2002 and 2006, relating to organic carbon, lead contamination and salinity.²³⁷

Soil organic carbon content is one of the primary indicators of soil quality, as it is a source of plant nutrients and influences the exchange of nutrients, water retention, soil structure and its stability, and soil biodiversity. Human activity, principally intensive cultivation, is one of the most important causes of declining organic matter.²³⁸ In 2006, the average organic matter in the sampled topsoils was 2.1 percent, 0.2 percent more than in 2002, and just above the 2.0 percent soil organic carbon threshold below which potentially serious decline in soil quality is expected to occur.²³⁹

Soil contamination can pose risks to human health, soil function, and the wider environment; sites with a degree of inevitable contamination in view of on-site activities include: petrol stations; power stations; waste dumps; the IPPC²⁴⁰ sites; fuel depots; industrial areas; and, scrap yards.²⁴¹ Since data on soil contamination remains scanty, lead concentrations in topsoils may be used as a proxy to monitor contamination.²⁴² The average content of lead in the 16 sites monitored increased from 78 milligrams per kilogram (mg/kg) in 2002 to 125mg/kg in 2006, with highest concentrations at Paola (451mg/kg, up from 266mg/kg in 2002). Lead concentrations generally exceed 100mg/kg in south and central Malta. Possible causes of lead in soil include remnants from car exhaust, paint, used pellets from hunting or emissions from industrial activities.²⁴³

Soil salinisation, or the excessive increase of soluble salts in the soil, is among the most important and widespread of soil degradation processes.²⁴⁴ Maltese soils are vulnerable to soil salinisation, with irrigation using salt-rich groundwater a major direct cause. Between 2002 and 2006, average soil conductivity (indicating salinity) increased by 30 percent, from 581 micro Siemen per centimetre ($\mu\text{S}/\text{cm}$) to 756 $\mu\text{S}/\text{cm}$ at the sites monitored. Highest values were recorded in coastal areas where salt from sea spray is deposited, such as Mgarr (1,580 $\mu\text{S}/\text{cm}$ in 2006). **There is a need for Malta to update national legislation and build capacity for monitoring and enforcement in this area.**





CHAPTER 5

FRESH WATERS

KEY MESSAGES:

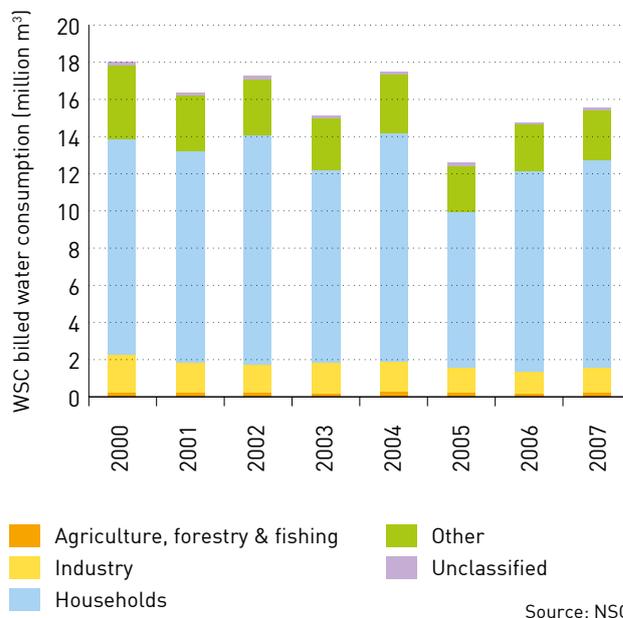
- » Malta's groundwater resources are being over-exploited due to widespread unauthorised abstraction, with resultant sea water intrusion. Since this is already impacting the ability of Malta's groundwater resources to meet the needs of the population in terms of water quality, legal measures need to be taken to address the situation.
- » Contamination of groundwater bodies with nitrates is of major concern.
- » Improved water demand management is required in order to reduce wastage and raise efficiency levels of water use. In particular, water pricing needs to be extended to private water supplies, in order to improve demand management over the whole spectrum of water use, with the wider sustainability goals in mind.
- » While three new Sewage Treatment Plants are being developed, the obstacles with respect to re-use of treated effluent, related to effluent quality and the requirement for an effective and efficient distribution system, need to be addressed so as to permit re-use of such water resources.
- » There needs to be better and more innovative management of urban and rural run-off water, through environmentally sustainable measures that respect natural processes within valleys.

Fresh water remains a scarce natural resource in the Maltese Islands, due to their high population density and arid climate. Malta has met its fresh water needs through historically low water demand, demand management and considerable use of desalinated water. However the latter has come at a high financial and environmental cost due to the imported fossil fuels used to run the desalination plants. These issues, coupled with ever-increasing demand for fresh water,²⁴⁵ make it imperative to ensure sustainable water management practices in the Islands.

The primary legislative framework for water management in Malta derives from the Water Framework Directive (WFD),²⁴⁶ which aims at achieving good water status for all groundwaters and surface waters by 2015. In line with this Directive, Malta's waters have been classified in terms of groundwaters, transitional waters, inland surface waters, and coastal waters.²⁴⁷ The Malta Resources Authority (MRA) and MEPA cooperate on the regulation and management of water. While MRA is responsible for the management of groundwater and surface waters, MEPA is responsible for the management of coastal waters, transitional waters, and inland surface waters in protected areas. After reviewing trends related to water production and consumption, and the key pressures on Malta's fresh water resources, this chapter reviews the status of groundwater and inland surface waters, before closing with a brief discussion of actions taken to improve water status and some emerging water issues.

Malta's potable water supply originates from groundwater and desalinated water. Groundwater is abstracted from the aquifers while three reverse osmosis plants produce desalinated water. Water production from the principal water supplier, the Water Services Corporation (WSC), decreased by six percent between 2004 and 2008, falling from 32.78 to 30.95 million m³ in this period. There has been a parallel drop in groundwater abstraction since 2004, which decreased from 14.89 to 14.08 million m³ between 2004 and 2008. Desalinated water made up 55 percent of WSC production in 2008. Although desalination alleviates the problem of groundwater over-abstraction, it involves high levels of energy consumption: in 2007 water production utilised five percent of the total electricity produced.²⁴⁸

Chart 5.1: Billed water consumption by sector



Note: The above refers to actual consumption, and estimated consumption is not included. The Unclassified sector refers to economic units that could not be classified by NACE code (statistical classification of economic activities in the EC).

The overall trend in water consumption is also one of decline (Chart 5.1). The three major consumers of WSC billed water are households (72 percent in 2007), farms and industry (including tourism). The difference between WSC water production (30.97 million m³ in 2007) and billed water consumption (15.57 million m³ in 2007) is made up of unaccounted-for-water (consumed but not billed) and real losses, which are related to leakages. This difference is likely to be due to a number of factors. Indeed, more in-depth analysis is needed to understand the factors behind the difference between production and consumption, in order to improve efficiency of resource use. Between 2004 and 2007 apparent water losses decreased by 42 percent and real losses (leakages) declined by 34 percent.

The two principal pressures on Malta's fresh water resources are: abstraction from and pollution of water bodies. Over-abstraction is of particular concern due to the risk of groundwater depletion, particularly in view of the proximity of groundwater bodies to the sea, which results in saltwater intrusion. Groundwater bodies in the Maltese Islands are principally replenished through rainwater infiltration, and to a lesser extent from leaks from the public water distribution system. Unfortunately, some 50 percent



of water recharged into the aquifer systems is lost through subsurface discharge. The magnitude of the recharge lost is high enough to justify the investigation of methods, based on a mathematical model of the aquifer, to reduce this loss of groundwater.²⁴⁹ Malta's recharge water volume available for extraction is estimated at an average of 23 million m³ per annum.²⁵⁰ WSC groundwater abstraction in 2008 amounted to 14 million m³. However, when private abstraction, which is estimated to account for 20 million m³ per annum,²⁵¹ is considered, it is evident that there is net over-abstraction. This indicates that **Malta's groundwater resources are being over-exploited, due to widespread unauthorised abstraction, with resultant sea water intrusion. Since this sea water intrusion is already impacting the ability of Malta's groundwater resources to meet the needs of the population in terms of water quality, legal measures need to be taken to address the situation.** The difficulty in quantifying the extent of private groundwater abstraction poses challenges for the integrated management of Malta's groundwater resource.

Another major pressure on fresh water quality relates to sources of nitrate pollution: livestock breeding units and fertilizer over-use.²⁵² Excessive use of pesticides is also a potential pressure, however pesticide pollution in groundwater has not so far been detected.²⁵³ Potential discharges from industry may also be a matter of concern.²⁵⁴

The principal sources of nitrates in groundwater are waste from animal husbandry units and the excessive use of nitrogenous fertilizers. Improperly managed animal husbandry units can have a serious environmental impacts due to the large concentrations of nitrogenous wastes and other substances, which can migrate towards fresh water bodies unless appropriate precautionary measures are taken. The livestock breeding sector has undergone considerable restructuring since EU accession, however, and benefitted under the 2004-2006 Rural Development Plan²⁵⁵ from funds to help farmers modernise their premises and improve farm management, particularly with respect to the Nitrates Directive.²⁵⁶ Since the January 2008 deadline for compliance, 18 cattle farms were closed down due to non-compliance. However it is expected that, due to their large number and dispersed locations, farm units will continue to put pressure on Malta's water resources in the future.

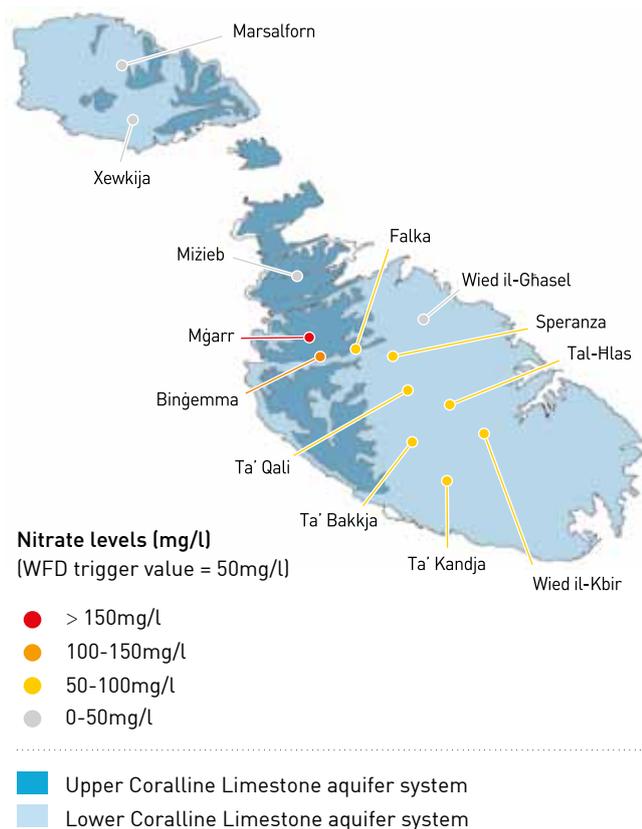
Intensive agricultural activities also exert pressure on fresh water quality due to their widespread use of fertilisers and pesticides.²⁵⁷ Fertiliser imports may be used to gauge the pressure that fertilisers are exerting on fresh water resources.²⁵⁸ Fertiliser importation patterns in Malta have been cyclical since 2000, but have registered a decline between 2006 and 2008.²⁵⁹ Pesticide imports in Malta peaked in 2003, followed by a decrease in 2004 and 2005. Pesticide imports ranged between 200 and 1,200kg per annum for pesticides in solid form, and 600 to 1400 litres per annum for liquid pesticides. Of particular concern are those components that are soluble and therefore may affect water bodies. Indeed, in 2007, out of 108,006kg of imported pesticides, 89.5 percent was sulphur, which is insoluble and therefore has no negative impact on water bodies.²⁶⁰

The status of Malta's groundwater may be assessed both qualitatively (chemically) and quantitatively. The principal concerns here relate to high levels of nitrates and chlorides.²⁶¹ While the sources of nitrate contamination are almost entirely anthropogenic, and include activities such as application of nitrogenous fertilisers that leach into the aquifer systems following rain, and contamination by leachates containing nitrogenous wastes, chloride contamination is both natural and anthropogenic, due to over-abstraction and seawater intrusion. High chloride concentrations are

largely a matter of concern due to their effect on the taste of drinking water. While no limit value for chloride currently exists, values higher than 250mg/l of chlorides in water²⁶² would be detectable by taste.²⁶³ A 50mg/l limit value has been set in the Nitrates Directive²⁶⁴ concerning nitrates in groundwater.

As in 2006, in 2007 nitrate levels in Malta's groundwater exceeded the EU limit in two-thirds (nine out of 13) of WSC pumping stations, and once again, the highest value (161mg/l) was recorded at Mġarr.²⁶⁵ The highest nitrate concentration in the Mean Sea Level Aquifer (MSLA) system was recorded, as in 2006, at the Speranza pumping station (97mg/l). Overall nitrate concentrations at WSC pumping stations have decreased by 0.6mg/l per annum between 2000 and 2007. Nevertheless, **contamination of groundwater bodies with nitrates is of major concern**, particularly in the light of national targets to achieve good water status (defined by the 50mg/l limit in the case of nitrates) by 2015.²⁶⁶

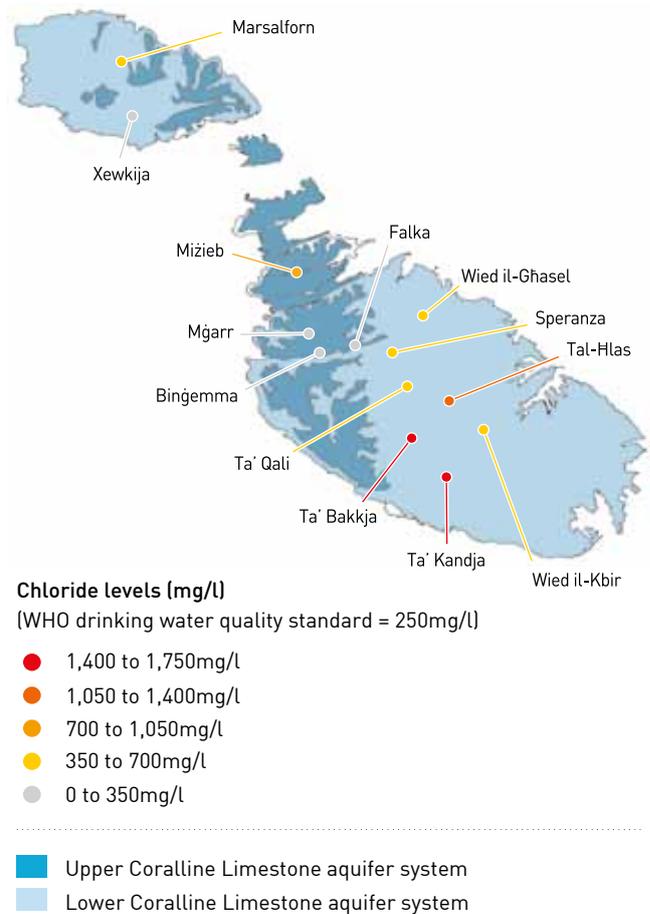
Map 5.1: Nitrates at WSC pumping stations (2007)



Source: MRA

As expected the 2007 average chloride concentration in the perched aquifer system was lower (185mg/l) than that of the MSLA system (726mg/l). The highest chloride concentration found in the MSLA was of 1,367mg/l, at Ta' Kandja, although chloride levels here fell by 32 percent between 2002 and 2007.

Map 5.2: Chloride levels at WSC pumping stations (2007)



Note: WHO drinking water standard may be used as a benchmark for groundwater but remains a very high standard in this context.

Source: MRA

The quantitative status of groundwater is also a matter of concern. Groundwater is one of Malta's few strategic natural resources. As reported in 2005, results from the 2003 characterisation of the quantitative status of groundwater²⁶⁷ indicated that the major groundwater bodies are being, or will soon be, over-abstracted, putting them at high risk.²⁶⁸ Over-abstractation is reflected in decreasing groundwater levels and spring flows. If this trend continues, it would increase the risk of losing Malta's only naturally renewable fresh water resource.²⁶⁹ The high level of urbanisation also reduces the natural replenishment of groundwater from rainfall. **This indicates that there needs to be better and more innovative management of urban and rural run-off water, through environmentally sustainable measures that respect natural processes within valleys**, which would also reduce the risk of flooding. Moreover **improved water demand management is required in order to reduce wastage and raise efficiency levels of water use. In particular, water pricing needs to be extended to private water supplies, in order to improve demand management over the whole spectrum of water use, with the wider sustainability goals in mind.** Global trends relating to climate change²⁷⁰ and fuel prices underline this need.

Inland surface waters provide important habitats for rare indigenous species, besides providing a water resource for artisanal agriculture. Monitoring programmes at key sites in line with international guidance indicate that the chemical quality of inland fresh water habitats is heavily influenced by human intervention. A total of seven inland²⁷¹ surface water bodies have been identified in the Maltese Islands and designated under the WFD, four of which are characterised as highly modified.²⁷² The major pressures on inland surface waters include agricultural practices, abstractions, littering, introduction of alien species, leaks from sewage systems and morphological alterations.

The principal actions taken to improve the status of water over the review period include measures to improve water quality, to reduce water losses, and to raise awareness about water-saving. Public information campaigns on more efficient use of water, together with periodic adjustments to water tariffs have also contributed, amongst other factors, to the decrease in overall water demand.²⁷³ Unconventional water production, such as from harvested rainwater and Treated Sewage Effluent (TSE), is also being investigated as an option to decrease demand on fresh waters. In 2006 the WSC took steps to reduce leakages from the water distribution system. In addition, energy audits carried out since 1997 have resulted in efficiency gains at desalination plants.

In terms of environmental monitoring, MEPA is consolidating its water quality monitoring programme to take into account a series of legal instruments [e.g. the Nitrates Directive²⁷⁴ and the WFD].²⁷⁵ In addition, the national groundwater monitoring system is being extended to address concerns related to other substances besides nitrates and chlorides. In this respect MEPA and MRA have been developing a programme of measures to address integrated management of water resources in Malta in accordance with the objectives of the WFD. In addition, an assessment of the contribution of the respective sources of aquifer contamination is also under way.

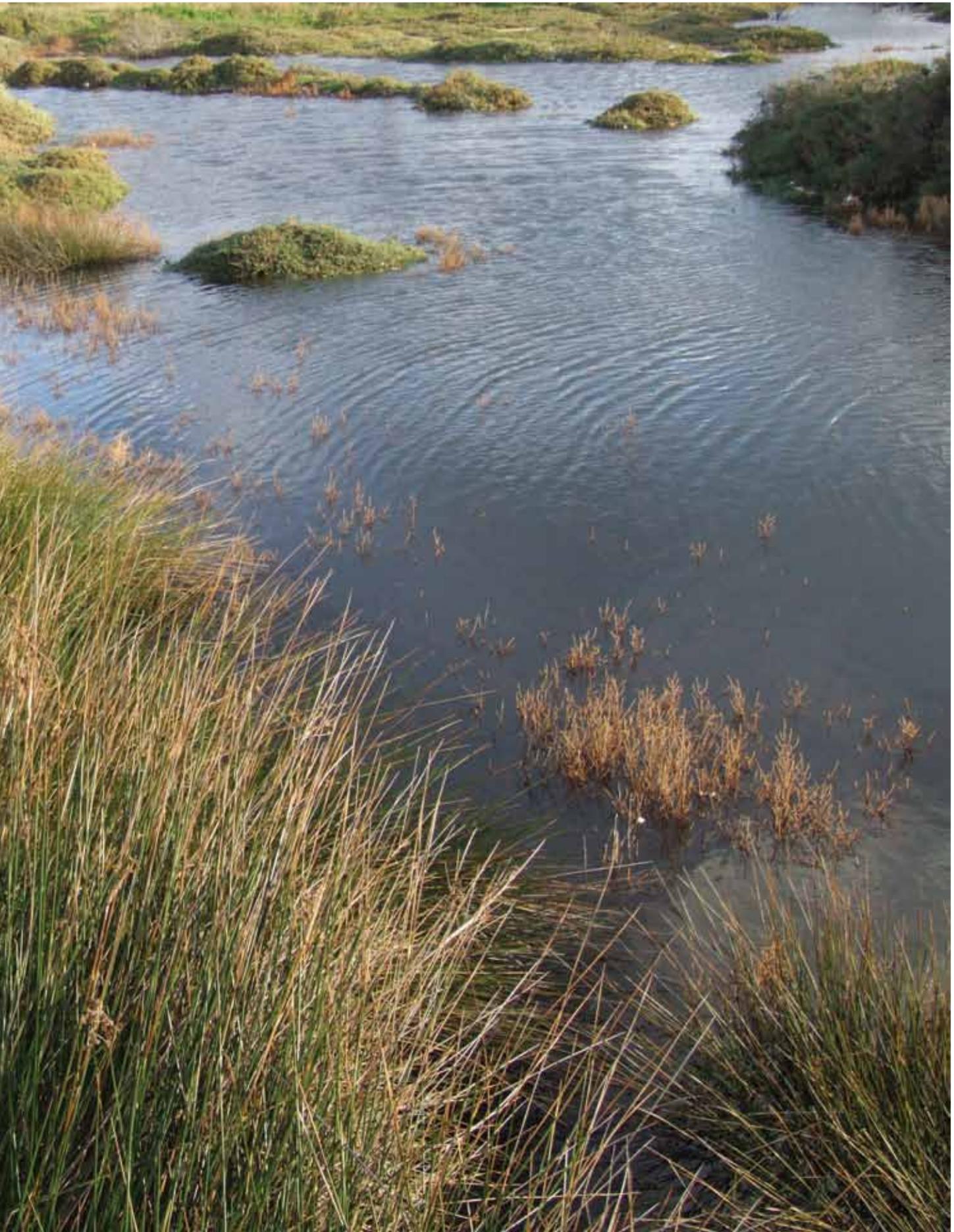
A number of emerging issues related to climate change, drought, floods and the extent to which Malta is able to use TSE, will have an important impact on fresh water in the future. Due to its expected impacts of sea-level rise and increased summer temperatures, climate change is expected to give rise to more evapotranspiration and a reduction in precipitation, coupled with a shift in precipitation patterns. This will in turn result in shorter rainy seasons with higher-intensity storms.²⁷⁶ Indeed, Malta's Reconnaissance Drought Index²⁷⁷ has been decreasing by 0.106 per decade since 1950, indicating increased drought periods.²⁷⁸ This will impact the aquifer systems due to the decrease in recharge from precipitation, although this will be a long-term effect, since the volume of water stored in such systems is larger than the annual recharge. Indeed the average age of groundwater abstracted from the MSLA system is approximately 40 years.²⁷⁹ This is not the case for the perched aquifer systems however, which, due to their smaller size, are directly dependent on annual precipitation. The reduced volume of groundwater available from groundwater sources, by decreasing water availability, would increase demand for desalination, which in turn would increase energy demand.²⁸⁰

Higher intensity storms resulting from climate change are expected to increase flooding events, with a parallel reduction in recharge rates. Options for mitigating these impacts include use of unconventional water - rainwater harvesting, which would help mitigate flooding, and TSE. Run-off collected via surface reservoirs and dams is a significant source of fresh water: it was estimated in 2007 that agriculture depended on rainwater runoff for 12 percent of its water supply.²⁸¹ Annual potential surface runoff was estimated at 24 million m³ in 2004, while volume of harvested rainwater has been estimated to reach 4 million m³. This suggests that there is considerable potential for improved rainwater harvesting.

The extent to which Malta is able to use its TSE is another important emerging issue. Malta was obliged under the Urban Waste Water Directive,²⁸² to subject all waste water to secondary treatment or equivalent prior to discharge by 2007. However it was not able to meet this target, although as of end 2008, two of the three plants envisaged, those in Gozo and in the North of Malta, were operational. Once all these plants are on line, approximately 19.7 million m³ of TSE will become available for re-use.²⁸³

TSE, if adequately treated, could be used in the agricultural and industrial sectors, for landscape irrigation, groundwater recharge and recreational and environmental purposes, subject to any necessary permits. Re-use potential is however constrained by a number of factors: its price relative to other water sources; its quality in relation to dissolved salts; lack of clear health guidelines relating to use of TSE; and, lack of effluent distribution system. This suggests that **while three new Sewage Treatment Plants have been or are being developed, any obstacles with respect to re-use of treated effluent, related to effluent quality and the requirement for an effective and efficient distribution system, need to be addressed so as to permit re-use of such water resources.**







CHAPTER 6 COASTAL AND MARINE ENVIRONMENT

KEY MESSAGES:

- » Malta's coastal and marine environment is under considerable pressure from activities in sectors such as housing, tourism and recreation, shipping, fisheries and aquaculture, and waste, but is also threatened by climate change.
- » There is lack of information about the status of Malta's coastal and marine environment, including that of the priority species and habitats within them.
- » Malta's bathing waters were 99 percent compliant with EU bathing water standards in 2008.
- » Malta has so far designated two Marine Protected Areas. These designations will yield results once the respective management plans have come into force. Further designations are required to ensure that coastal habitats and species of ecological importance are protected.
- » The trend towards improved beach management and Blue Flag certification can have positive environmental benefits. Blue Flag standards are also needed for natural sandy beaches. The focus on artificial beach creation and beach replenishment has still left knowledge gaps as to their long-term ecological effects, and the potential for beach replenishment needs to be investigated in the context of climate change adaptation.
- » The next step forward for the protection of the coastal and marine environment is to formulate a national vision for marine areas, which integrates environmental protection with the sustainable use of coastal and marine environments, in the form of a marine spatial plan that builds upon the recommendations of various sectoral plans addressing Malta's sea space.

Malta's coastal and marine environment is of importance due to the rich biodiversity it contains, but also because of the ecosystem services it provides (such as clean water and fisheries) to various coastal uses. This chapter examines the pressures on Malta's coastal and marine environment, the status of these areas, and the policy responses currently being taken to improve them.²⁸⁴ The coastal zone is taken to contain both coastal land and coastal waters, with the latter extending to 12 nautical miles (Nm) offshore, which corresponds with Malta's territorial sea boundary. The marine environment is taken as the area between the 12Nm boundary and Malta's 25Nm Fisheries Conservation Zone.

Malta has several policy obligations related to the coastal and marine environment, particularly relating to the WFD,²⁸⁵ the EU Integrated Coastal Zone Management Recommendation,²⁸⁶ the Urban Waste Water Treatment Directive,²⁸⁷ the Bathing Water Quality Directive²⁸⁸ and the UN Barcelona Convention.²⁸⁹ Interesting policy developments over the review period include the EU Marine Strategy Directive,²⁹⁰ part of the wider EU Maritime Policy,²⁹¹ the Euro-Mediterranean 'Horizon 2020'²⁹² initiative to de-pollute the Mediterranean by 2020, and the innovative 2007 Barcelona Convention protocol on integrated coastal zone management, through which parties agreed to integrated approaches to control coastal pressures.²⁹³

Due to their geographical characteristics, limited area and intrinsic attractiveness, coastal and marine environments are under considerable pressure from human activities, the most significant being urbanisation, tourism and shipping.²⁹⁴ Unfortunately, much of the development, as well as many activities taking place in the coastal land, tend to result in singular or limited uses, which increases competition for the use of such land. Pressure for urbanisation has been considerable during the review period. Demographic and housing trends provide a snapshot of coastal urbanisation pressures: the highest population growth rates in the 10-year intercensal period were in the seaside resort localities of Marsascala (96 percent) and St. Paul's Bay (81 percent).²⁹⁵ The second major pressure on coastal areas arises from tourism, including local tourism, which increases coastal populations, as well as hotel, holiday apartment and marina development. The number of second residences, the large majority of which are found in localities directly adjacent to the sea, and used by both foreign and local tourists, rose from 12,738 to 39,700 between 1995 and 2005. Marinas also contribute to coastal urbanisation and artificialisation, and the number of yacht berths increased by 66 percent from 1,092 in 1995 to 1,807 in 2008.²⁹⁶ Pressure for additional marina berths continues, with Malta Maritime Authority's proposals²⁹⁷ for three permanent marinas at Sa Maison, Ta' Xbiex and the Menqa, Marsa, along with 10 temporary marinas.²⁹⁸ Tourism also gives rise to pressure on beaches, which are generally ecologically sensitive (and protected) in the form of increased littering and waste generation on both sandy and rocky beaches, illegal camping and construction of boat houses, as well as additional requests and permissions for beach concessions and the holding of public events. Nevertheless, when improved coordination between responsible agencies²⁹⁹ has taken place, there has been progress in beach management, such as in St. George's Bay. Indeed, management approaches need to be in line with the natural processes within beaches to avoid the risk of loss of the beach material itself. Therefore, there is a need for strong efforts to improve beach management by all agencies, on the basis of codes of practice, common objectives and clear and enforceable permitting arrangements. Opportunities presented by the Blue Flag voluntary scheme³⁰⁰ and the new Bathing Water Directive³⁰¹ should not be missed.

Shipping constitutes the third major pressure on coastal and marine environments, and this activity involves both pollution-related and spatial impacts. Shipping not only exposes marine environments to disturbance of sediments, introduction of alien species, release of hazardous chemicals and chemicals related to anti-fouling paints, and increased vulnerability to oil spills,³⁰² but also creates demand for



coastal land for storage related to cargo-handling, which may give rise to conflicts with other coastal uses such as recreation.³⁰³ Shipping pressures may be monitored on the basis of gross shipping tonnage reaching Maltese ports, which increased by almost 70 percent between 2000 and 2008.³⁰⁴ Bunkering, which often takes place in shallow waters, and in the case of the North-West of Malta, near a marine protected area, also raises environmental concerns due to risk of oil spillage and disturbance of habitats. The number of vessels that came within Malta's territorial waters for bunkering operations increased by 35 percent between 2006 and 2007.³⁰⁵ Malta is currently equipped to address more minor oil spills, but the review of the national contingency plan for emergencies in this regard needs to be finalised, and complemented by fully-trained personnel.

Other pressures on coastal and marine areas include fisheries and aquaculture, waste disposal³⁰⁶ and climate change. The latter is expected to give rise to increased sea temperature and level, more storm surges resulting in coastal floods, changes in alkalinity and salinity and increased pollution from freshwater and land-based pollutant run-off. Since most of the important coastal habitats and recreational spaces on the Maltese coast are low-lying, any rise in sea level, or increases in storm surges, is likely to impact these areas, principally through erosion.

Transitional waters³⁰⁷ are generally saline marshlands in the Maltese context, containing specialised organisms adapted to thrive in the harsh conditions presented by these seasonally-dynamic habitats.³⁰⁸ Due to their limited extent, these marshlands are under considerable threat from urban and tourism development, flood relief projects, road works, waste disposal, vandalism, pollution and trampling.

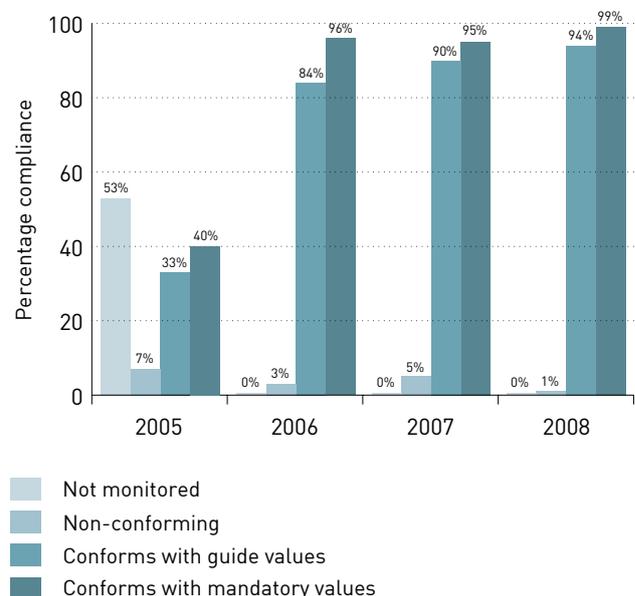
This review indicates that **the coastal and marine environment is under considerable pressure from various (often conflicting) human activities**, particularly during the summer. **These include pressures from activities in sectors such as housing, tourism and recreation, shipping, fisheries and aquaculture, and waste, but these areas are also threatened by climate change.**

The status of the coastal and marine environment may be assessed through chemical and biological parameters, and monitoring programmes along these lines are in being put in place, in the context of the WFD (see below). At present, however, **there is lack of information about the status of Malta's coastal and marine environment, including that of the priority species and habitats within them.** Nevertheless, a number of proxy indicators may be used to assess the status of these areas, of which the principal ones are coastal artificialisation and erosion, and bathing water quality.

Coastal artificialisation is one of the principal concerns in coastal land environments, as it leads to the loss of habitats, biodiversity, landscape value, and public accessibility, and increases the risk of erosion.³⁰⁹

Malta's artificialised coastline increased by approximately one percent between 1994 and 2004, relating particularly to harbour, road and recreational infrastructure.³¹⁰ Some 16 percent of Malta's coastline was estimated to be susceptible to erosion in 2006, raising concerns related to potential impacts on important tourism and recreational resources such as sandy beaches, exposed clay slopes and boulder screes. While MEPA investigations on four erosion-susceptible sites between 1998 and 2004 do not indicate significant coastal impacts through erosion at these sites,³¹¹ particular studies, such as that for Sliema,³¹² indicate that there may be grounds for concern. Nevertheless, more detailed monitoring is required before any concrete conclusions can be made.

Chart 6.1: Classification of bathing water sites according to EU Bathing Water Quality Directive



Source: Department for Environmental Health

Bathing water quality is a key indicator of coastal water quality, due to its importance for health, recreation and tourism. Malta is obliged to achieve water quality standards under the Bathing Water Directive,³¹³ and the UN Barcelona Convention.³¹⁴ Compliance with mandatory values under the former increased considerably between 2005 and 2008, such that **in 2008 Malta's bathing waters were 99 percent compliant with EU bathing water standards** (Chart 6.1). Compliance with more stringent guide values increased from 33 percent in 2005 to 94 percent in 2008. The step change in this period was due to the reduction in the number of insufficiently-sampled bathing sites with respect to physico-chemical parameters. In terms of the Barcelona Convention, 100 percent of sites classified as (guideline and more stringent) Class One (62 percent) or as the mandatory Class Two. The number of Class One sites increased by almost 30 percent between 2005 and 2008.

The major actions taken by Government in response to coastal and marine issues include: preparation of strategies and plans; monitoring; upgrading of infrastructure; beach management, and, site designation.

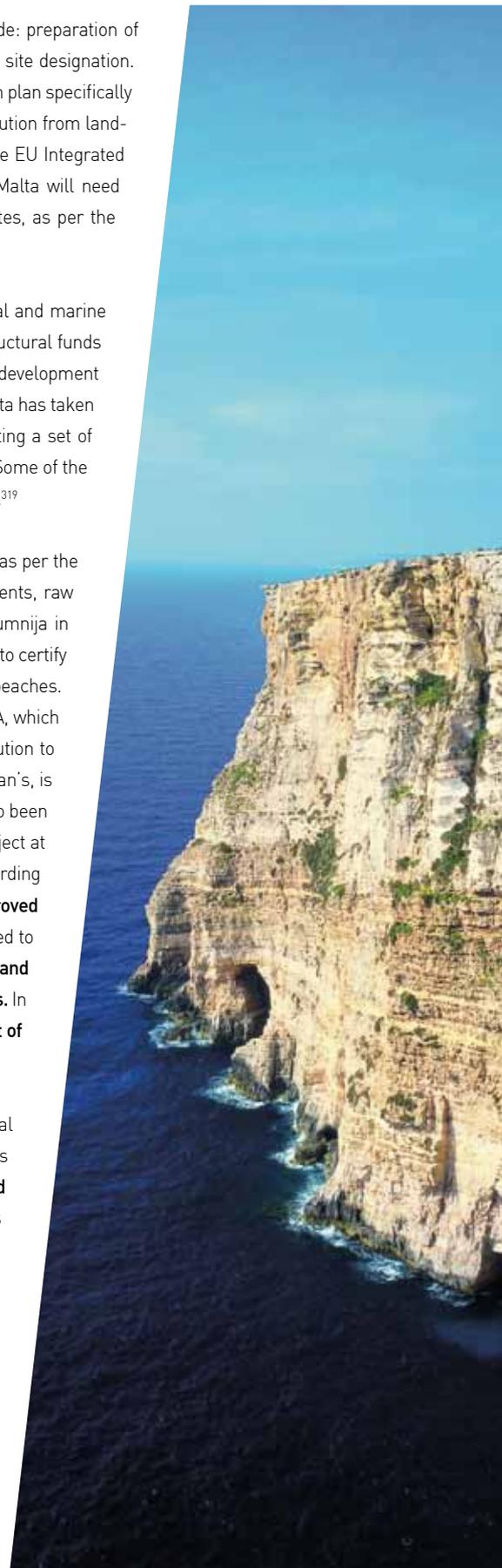
The three principal planning initiatives taken during the review period are: a national action plan specifically on coastal and marine biodiversity under SAP BIO;³¹⁵ a 2005 National Action Plan regarding pollution from land-based activities,³¹⁶ and the incorporation of Malta's national coastal strategy, required under the EU Integrated Coastal Zone Management Recommendation,³¹⁷ into the draft Replacement Structure Plan. Malta will need to prepare a national marine strategy by 2016, in cooperation with neighbouring Member States, as per the requirements of the proposed European Marine Strategy Directive.³¹⁸

In line with monitoring requirements under various legal instruments, a comprehensive coastal and marine environmental monitoring programme is currently being put in place within the context of a structural funds project, which aims to be operational in 2010. Short-term monitoring programmes on various development projects and pollution issues have also been carried out. In addition, during the review period Malta has taken a prominent role in the EU-funded DEDUCE project, through which MEPA was involved in testing a set of sustainability indicators for the coast, identified by the EU's coastal management expert group. Some of the methodologies developed within this project have been used to inform the analysis of this Report.³¹⁹

Infrastructural improvements include the construction of three new sewage treatment plants³²⁰ as per the requirements of the Urban Waste Water Treatment Directive.³²¹ By means of these developments, raw sewage is no longer being discharged at sites such as San Blas, Ras il-Hobż in Gozo and Ċumnija in Malta. Another important policy response has been the initiative to begin to manage beaches and to certify them. The Malta Tourism Authority (MTA) has been tasked with ensuring the cleanliness of beaches. However, as noted earlier, a more coordinated approach between MTA, local councils and MEPA, which takes a wider³²² view of beach management, is required. Blue Flag certification might be a solution to some of these issues, but so far only one artificial Maltese beach,³²³ at St. George's Bay, St. Julian's, is certified,³²⁴ and **Blue Flag standards are also needed for natural sandy beaches.** There have also been initiatives during the review period to create artificial beaches: so far a beach replenishment project at St. George's Bay, St. Julian's has been completed. However, so far no monitoring data exists regarding the longer-term effects of this project on the environment. Although **the trend towards improved beach management and Blue Flag certification can have positive environmental benefits** related to safeguarding coastal ecological processes and resources, **the focus on artificial beach creation and beach replenishment has still left some knowledge gaps as to their long-term ecological effects.** In addition, **the potential for beach replenishment in Malta needs to be investigated in the context of a national strategy on climate change adaptation.**

Various international agreements³²⁵ oblige Malta to establish and manage protected sites in coastal and marine areas, and **Malta has designated two Marine Protected Areas**, at Rdum Majjiesa / Ras ir-Raheb and Dwejra, Gozo, covering 11km² of territorial waters. **These designations will yield results once their respective management plans have come into force, and further designations are required to ensure that coastal habitats and species of ecological importance are protected.**

To complement the current set of policy measures in force to protect coastal and marine environments, there is also need for better coordination between actors. This is already taking place through *ad hoc* coordination of work, and through collaborative management of protected areas, and it is envisaged that the integrated approach required in the EU Marine Strategy should also encourage better policy integration. The issues raised in the report suggest that **the next step forward is now to formulate a national vision for marine areas that integrates environmental protection with the sustainable use of coastal and marine environments, in the form of a marine spatial plan that builds upon the recommendations of various sectoral plans addressing Malta's sea space.**





CHAPTER 7

RESOURCES AND WASTE

KEY MESSAGES:

- » Malta has a relatively low consumption of material resources per capita, although certain natural resources such as land, water, limestone and renewable energy are not being utilised efficiently. Malta's domestic material consumption fell between 2004 and 2006, despite GDP increase, suggesting that economic activity is becoming less resource-intensive. Material productivity also increased.
- » There have been significant improvements in the availability of waste data, although in order to obtain a better picture of waste generation there is need to improve data quality for certain waste streams.
- » New legislation has been enacted to control waste management through registration, permitting and reporting activities, which have also promoted waste recovery, including recycling. New facilities for waste management have also been commissioned.
- » In order to achieve targets related to the EU waste acquis, and significantly reduce the amount of waste going to landfill, there is need for new and improved incentives to encourage waste separation and recycling, as well as recovery operations.
- » New littering legislation with higher penalties has been enacted. However, certain areas of Malta remain characterised by high levels of littering and dumping, and more enforcement is required to address this issue.
- » There is a need to address the construction, demolition and excavation waste issue from a long-term perspective, in order to reduce the environmental damage and resource depletion associated with these activities. Planning conditions with respect to excavation and demolition methods, quality standards, and pricing measures that internalise environmental costs, and encourage re-use, are also required.
- » In order to meet EU targets Malta will need to continue to invest in the regulatory and operational infrastructure on the basis of new policy instruments, programmes and actions and allocate sufficient resources for implementation.

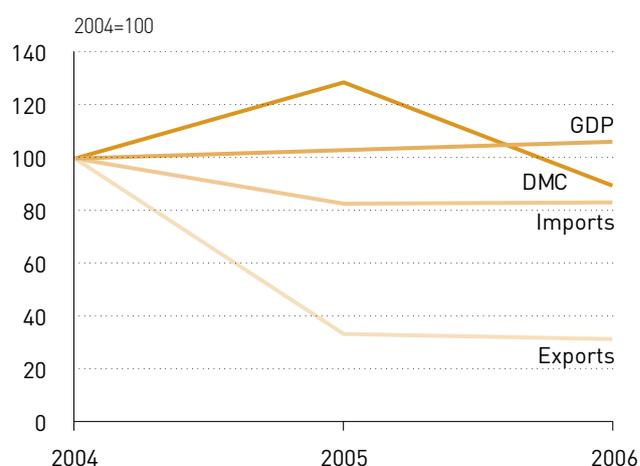
A primary concern for sustainable development is that natural resources, both renewable and non-renewable, are used in a way that respects environmental capacity limits, while ensuring that human needs are met. To this end, the European Commission adopted its 2005 strategy³²⁶ on the sustainable use of natural resources, with the aim of reducing the environmental impacts associated with resource use. The efficiency of an economy in its use of resources may be measured both in terms of the flow of materials through the economy, as well as by the amount and type of waste generated, so this chapter reviews both how efficient Malta is in its use of material resources, as well as waste generation and management in the Islands.

In order to estimate the quantity of materials consumed by a national economy, indicating dependency on physical resources and use of scarce resources, Eurostat's Domestic Material Consumption (DMC)³²⁷ indicator, along with its associated material flow indicators,³²⁸ may be used. The indicators presented here have been estimated for Malta for the first time.³²⁹

Between 2004 and 2006, direct extraction³³⁰ fell by 10.6 percent (Table 7.1), due to lower levels of mineral extraction. Since 2004, the mass of imports used in Malta's economy also decreased, by 17.3 percent, largely due to fewer imports of fossil fuels. Due to these trends, Direct Material Input³³¹ decreased by 15 percent between 2004 and 2006. In the same period the mass of exports decreased by 69.3 percent, mainly due to reduced fossil fuel exports³³² (a decrease of 84.1 percent).

Overall, **DMC in Malta has fallen 4.8 percent between 2004 and 2006**, resulting from lower levels of domestic extraction and imports. **During this period GDP at real prices rose 6.7 percent, suggesting that economic activity is becoming less resource-intensive. Material productivity,³³⁴ which indicates the relationship between material use and economic activity, also increased**, indicating growing material efficiency that suggests some progress towards sustainability.

Chart 7.1: Material Flows



Source: Gazley and Moncada 2008

Despite limited data comparability,³³⁵ it is possible to obtain a first broad brush indication of how well Malta performs compared to selected EU Member States in terms of resource efficiency. Malta,

Table 7.1: Domestic material consumption³³³

Indicator	2004	2005	2006	2004-2006 % change
Domestic material consumption	3,422,946	3,718,648	3,256,961	- 4.8
Of which: Biomass	662,682	568,908	522,867	- 21.1
Minerals	1,704,889	1,969,749	1,757,113	+ 3.1
Domestic extraction	1,246,498	1,605,430	1,114,368	- 10.6
Domestic material input	4,065,222	3,931,036	3,454,442	- 15.0
Imports	2,818,724	2,325,605	2,340,074	- 17.0
Exports	642,277	212,388	197,481	- 69.3
GDP (constant 2000 prices) (€ 000)	4,021,374	4,150,526	4,291,367	+6.7

Source: MEPA, NSO



at 8.5 tonnes per capita, had a relatively low level of domestic material consumption per capita in 2004,³³⁶ when compared with EU countries such as UK, Italy and Greece, values for all of which were over 10 tonnes per capita.

These calculations indicate that **Malta has a relatively low consumption of material resources per capita, and that Malta's domestic material consumption fell between 2004 and 2006, despite GDP increases, suggesting that economic activity is becoming less resource-intensive.** However, **certain natural resources such as land, water, limestone and energy³³⁷ are still not being utilised efficiently** due to a complex set of structural, economic, social and technical reasons.³³⁸

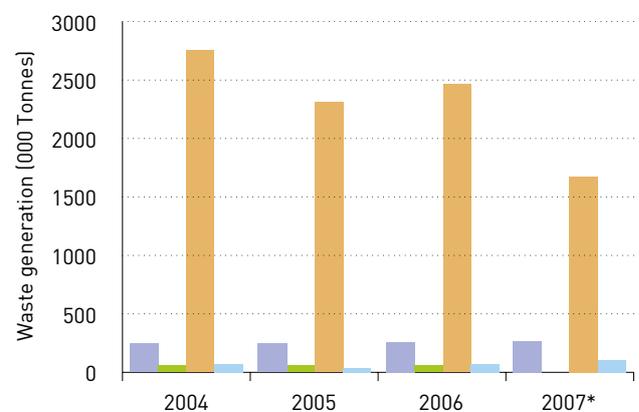
Turning to waste generation and management, Malta's policy framework here is to a large extent guided by EU waste policy, which focuses on limiting waste generation and decoupling it from economic prosperity. EU policy³³⁹ is based on the waste hierarchy, whereby it is recognised that waste should be prevented or reduced, and that what is generated should be recovered by means of re-use, recycling or other recovery options, in order to reduce waste going to landfill.³⁴⁰

The EU's principal waste policy is its Thematic Strategy on the Prevention and Recycling of Waste,³⁴¹ which includes waste prevention targets and measures required to achieve them, and which led to a revision of the Waste Framework Directive.³⁴² Particular EU directives address specific waste streams, including packaging and hazardous waste, while others address waste management options such as landfilling and incineration. These directives include a number of targets, such as, for example, that the amount of biodegradable municipal waste going to landfill must be reduced to 75 percent³⁴³ by July 2010,³⁴⁴ and that by 2009, 50 percent of packaging waste will need to be recovered and 45 percent recycled.³⁴⁵ In January 2009 the Ministry for Resources and Rural Affairs presented a

consultation document on 'A Solid Waste Management Strategy for the Maltese Islands' with the aim of a zero waste society, in which all waste is changed into a resource. This is the first revision of the strategy published by Government in October 2001.

Trends in waste generation indicate reductions over the review period, and this has been felt in most waste streams, except packaging and hazardous waste. Between 2004 and 2006,³⁴⁶ waste generated fell by 9.49 percent to nearly 2.3 million tonnes (Chart 7.2). In 2006, the majority (80 percent) of this waste was landfilled, while the rest was recycled, stored, exported or dumped at sea.

Chart 7.2: Waste generated by type



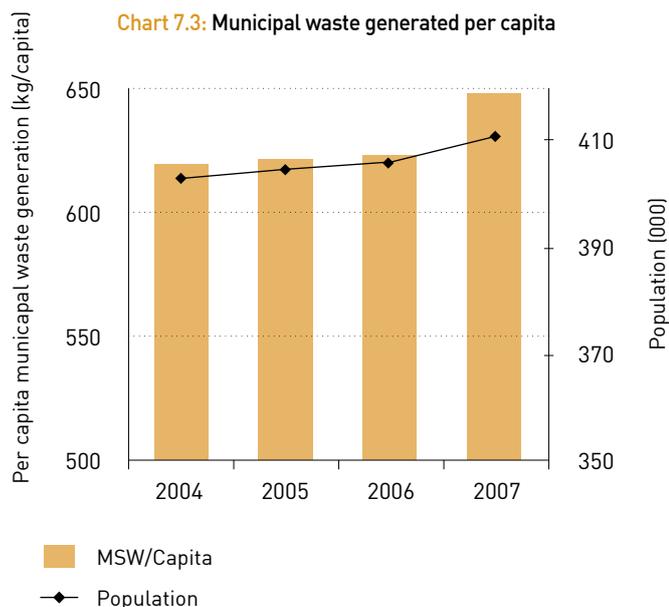
* 2007 data is subject to review. In addition 2007 data for hazardous waste, recycled construction waste and part of the data of waste disposed of in privately owned quarries was not available at the time of publishing.

- Municipal
- Hazardous
- Construction & Demolition
- Commercial & Industrial

Source: NSO

Trends in the municipal waste generation³⁴⁷ stream are currently the best indicator for assessing performance in terms of generation and management of waste, due to their close relationship to consumption and to GDP.³⁴⁸ Municipal waste generated increased by six percent between 2004 and 2007, up to 265,947 tonnes in 2007.³⁴⁹ The majority of this was landfilled, with seven percent being recycled declining from 19 percent in 2006. The reason for these changes relates to the temporary closure of the Sant' Antnin waste treatment plant, which is Malta's principal waste recycling facility, for upgrading. In 2007 municipal waste generated per capita was 648 kilograms per capita [kg/capita], increasing by 28kg/capita from that produced in 2004 (Chart 7.3), at which point only four of the EU27 countries had higher rates of municipal waste generated per capita.³⁵⁰ While municipal waste generation in EU-25 is projected to increase by 25 percent over 2005 values by 2020, growth in Malta is expected to exceed 60 percent.³⁵¹

Chart 7.3: Municipal waste generated per capita



Note: 2007 data is subject to review

Source: NSO

Packaging waste is an element of the non-hazardous, non-inert waste stream that is growing fast and representative of a significant loss of resources. It is estimated that up to 17 percent of EU municipal waste consists of packaging.³⁵² Packaging waste is estimated to have increased by 5.8 percent to 43,500 tonnes between 2004 and 2006. The Packaging Directive³⁵³ and related national legislation obliges producers to be responsible for products throughout their lifecycle, even when they have become waste. To this end, in 2007 all relevant Maltese producers were requested to register the amount of packaging put by them on the market. During 2007, 1,645 producers and importers had registered.³⁵⁴ Companies are required to recover a specified amount of this waste and prove that they have met their annual obligations to recover and/or recycle packaging waste.

Inert waste arises from the construction, maintenance and demolition of buildings and infrastructure. The principal environmental impacts of this waste stream are land take-up, depletion of the non-renewable resource and nuisance and pollution related to transport. Inert waste, which in Malta consists chiefly of construction and demolition waste, represented 87 percent of total waste generated in 2006.³⁵⁵ Construction and demolition waste generated decreased by 10.5 percent between 2004 and 2006 when it fell to 2.49 million tonnes. In an effort to reduce the amount of inert waste going to landfill, and to keep this inert waste stream uncontaminated by other types of waste, since 1997 a proportion of Malta's construction and demolition waste has been disposed of in spent quarries, at sea and through recycling. This process was stepped up in 2003. Between 2004 and 2007 the amount of construction waste dumped at sea fluctuated, but overall registered a decreasing trend of 22,000 tonnes per annum. A consignment note permit system covering the dumping of inert waste at sea was also

put in place in 2006. Recycling of construction waste increased fivefold from 19,916 to 101,756 tonnes between 2004 and 2006, but still only represents some four percent of this waste stream. Despite these efforts, progress in reducing and recycling inert waste is slow, suggesting that **there is a need to address the construction, demolition and excavation waste issue from a long-term perspective, in order to reduce the environmental damage and resource depletion associated with these activities. Planning conditions with respect to excavation and demolition methods, quality standards (such as standards for recycled materials), and pricing measures that internalise environmental costs, and encourage re-use, are also required.**

Hazardous waste³⁵⁶ represents a serious risk to the environment and human health if not managed and treated safely. In 2006, 53,600 tonnes of hazardous waste is estimated to have been generated in Malta, increasing by one percent since 2004. Most hazardous waste (97 percent in 2006) is stored awaiting eventual export from Malta to a location where it can be safely treated and disposed of.³⁵⁷ Exportation of hazardous waste increased fivefold between 2004 and 2006, from 255 tonnes in 2004 to 1,346 tonnes in 2006.

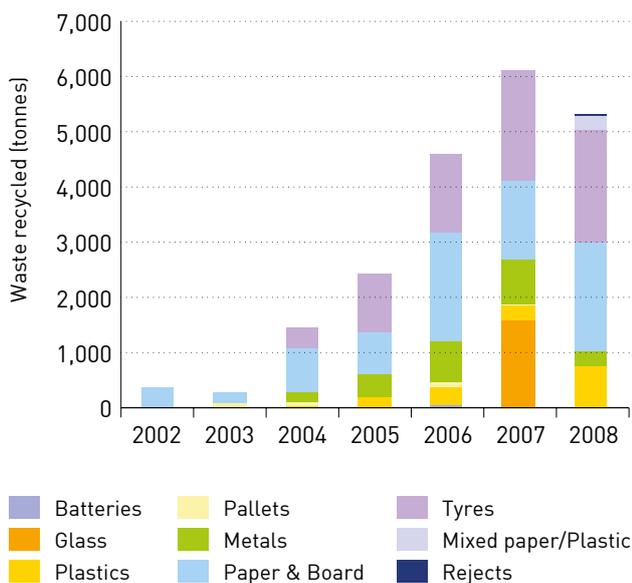
Since 2008, a more comprehensive waste dataset has been made available covering the period 2004-2006, including an inventory of hazardous waste based on production estimates from industry.³⁵⁸ **There have thus been significant improvements in the availability of waste data, although in order to obtain a better picture of waste generation there is need to improve data quality for certain waste streams.**

During the period under review, waste management in Malta has continued to undergo major changes. **Since 2005 new legislation has been enacted to control waste management through registration, permitting and reporting activities, which have also promoted waste recovery, including recycling. New facilities for waste management have also been commissioned.** At present, Malta's waste management practice depends relatively heavily on landfilling, which is still the most common waste management method used across the pan-European region,³⁶⁰ and its level of material recovery is low.³⁶¹



Since 2005 Malta's waste permitting and notification system has been strengthened and extended, with the objective of reducing risks to human health and ecosystems associated with waste management. Waste management permits and notifications cover the operations of waste management facilities, waste management collection schemes, and the transfrontier shipment of waste. Permitting conditions require operators to report on waste generated, managed or transported. During 2008, nine waste management permits were issued, two applications were refused, while three were withdrawn. During the same period, 920 waste registration applications were received and processed, 910 of which were related to waste management. Of these 787 were issued in 2008. With regards to transfer of waste within the island, a total of 482 permits were issued and 1,493 notifications of waste movements were processed. A total of 770 notifications for the export of Green List Waste³⁶² were also received. In addition, a total of nine permits for the export of waste from Malta were issued, four were withdrawn and five were still being processed as at end 2008.³⁶³ Furthermore, ten applications for wastes transiting through Malta were processed.

Chart 7.4: Waste recycled



Note: 2008 data is subject to revision.

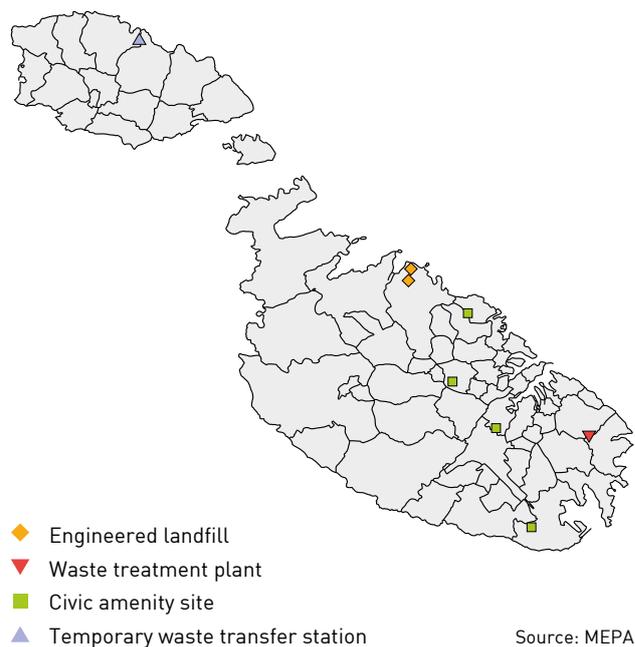
Source: WasteServ Malta Ltd.

There have also been significant efforts to promote recycling, which is the best waste management option after prevention and re-use. Recycling increased more than three times between 2004 and 2008, reaching 5,317 tonnes in 2008 (Chart 7.4), although there was a 13 percent decrease in recycling between 2007 and 2008, due to a drop in demand for recyclables, which is highly dependent on international markets. Recycling of tyres made up 39 percent by weight of all recycled waste, followed by paper and cardboard at 37 percent. Bring-in sites are an important part of Malta's recycling infrastructure.

The amount of material collected in Malta's 226 such sites (plus a further 200 located in schools) increased more than fourfold between 2004 and 2008, from 963 to 4,107 tonnes. Civic amenity sites are also being established with the help of EU Structural Funds, to allow the discarding of bulky household waste, thus improving the collection of certain types of waste and increasing the recovery of secondary materials. By end 2008, four (Maghtab, Mriehel, Hal Far and Luqa) out of the five civic amenity sites planned were operational and they received 23,318 tonnes of waste between December 2006 and December 2008. Furthermore, the Recycle Tuesdays initiative ensured that 4,250 tonnes of separated waste were collected from households between May and December 2008. Nevertheless the overall amount of waste recycled remains relatively low, at only seven percent of municipal waste generated in 2007.

In order to promote waste recovery, which is the process of obtaining materials or energy from waste,³⁶⁴ the eco-contribution scheme was introduced in 2004. This scheme levies products that generate end-of-life products or waste, to ensure better disposal, re-use or recycling. Producers listed in the Eco-Contribution Scheme Register are eligible for refunds on the amount of eco-contribution paid during the previous year, subject to a minimum recovery rate of 25 percent. In addition, through the Waste Electrical and Electronic Equipment Directive³⁶⁵ producers have been made responsible to take back and recycle electrical and electronic equipment, thus limiting waste going to final disposal.³⁶⁶ The new Thermal Treatment Facility in Marsa (previously the incinerator at the Marsa abattoir) started operating in December 2007 and treats abattoir waste, clinical waste, refuse-derived fuel,³⁶⁷ and other waste such as used solvents and industrial sludges. The facility made it possible to decommission other non-compliant

Map 7.1: Major waste management facilities 2008



Source: MEPA

incinerators, including those at the St Luke's and Gozo Hospitals.³⁶⁸ In 2008, 5,683 tonnes of waste were treated at this facility.

There has been significant progress in upgrading waste infrastructure over the review period. An interim engineered waste storage facility has been developed at Ta' Żwejra, and this is an environmentally-safe facility for the disposal of municipal solid waste. The Ghallis engineered landfill has been developed for the disposal of non-hazardous, non-inert waste and municipal solid waste, including residues from the Sant' Antnin plant. The site is expected to serve for a minimum period of seven years from 2007, but its use could be prolonged through waste minimisation and separation.³⁶⁹ A national system and facility for the interim storage, pre-treatment and export of certain hazardous wastes is planned at this site. In addition, another site at Ghallis has been developed with a capacity for approximately twenty years of hazardous waste treatment and disposal aimed at a limited range of solid hazardous wastes. Landfill gas is being collected at the Ghallis and Ta' Żwejra facilities, and the next step is for electricity to start to be generated in 2009.³⁷⁰ The temporary Gozo Transfer Station, replacing the Qortin waste dump, was set up for the receipt, sorting, processing, interim storage and transfer/transport of waste originating from Gozo and Comino, before it is transported to Malta for disposal.³⁷¹ As noted above, since 1997 a number of disused quarries have also been permitted to receive inert (construction and demolition) waste.

Waste management facilities also include the sites commissioned to encourage recycling. As noted earlier, these include the extensive network of bring-in sites, and the civic amenity sites, where the public has the opportunity to dispose of separated waste. The Sant' Antnin Plant is currently being upgraded to reduce the need for disposal of biodegradable municipal waste and a variety of source-segregated dry recyclable materials.³⁷² As of end 2008 upgrading had resulted in the setting up a Material Recovery Facility to process and treat 36,000 tonnes of dry recyclables per annum. Facilities to sort municipal waste and produce compost and biogas from that organic material, as well as clean electricity for the plant and 1,400 four-person households, were also envisaged. The Magħtab, Qortin and Wied Fulija dumps, which ceased operations in May 2004, are being rehabilitated into recreational parks through EU Structural funding.³⁷³

Furthermore, **new littering legislation with higher penalties has been enacted.**³⁵⁹ However, certain areas of Malta remain characterised by high levels of littering and dumping, and more enforcement is required to address this issue.

This review of waste management in Malta indicates that while significant progress has been made in upgrading the country's legislative framework and waste infrastructure, **in order to achieve targets related to the EU waste acquis, and significantly reduce the amount of waste going to landfill, there is need for new and improved incentives to encourage waste separation and recycling, as well as recovery operations.** In addition, following the update of the 2001 Waste Strategy that was launched in January 2009, **Malta will need to continue to invest in the regulatory and operational infrastructure on the basis of new policy instruments, programmes and actions, and allocate sufficient resources for implementation, in order to meet EU targets.**





CHAPTER 8

BIODIVERSITY

KEY MESSAGES:

- » The status of 29 percent of Maltese habitats and 36 percent of Maltese species listed in the Habitats Directive is still unknown. In addition, 64 percent of habitats and 44 percent of species have an inadequate or bad conservation status. Stringent measures are required for these to attain favourable status, while further surveys are needed to assess those with unknown status.
- » Invasive alien species represent a serious threat to Malta's biodiversity. Action plans are required to eradicate such species and prevent further introductions.
- » In order to identify actions to address the principal threats facing Maltese habitats and species of importance, further baseline studies and monitoring are necessary.
- » 28 Maltese sites have been included in the EU Natura 2000 network under the Habitats Directive, which, apart from the one marine site, cover 13 percent of land area. These sites are considered 93 percent sufficient in affording protection to the Maltese terrestrial habitats and species of community interest. 13 additional, but often overlapping sites covering 5.2 percent of land area have also been included as Natura 2000 sites under the Birds Directive.
- » Management of protected areas is being addressed by Government and by MEPA in partnership with non-governmental organisations. Structural funding has been allocated to accelerate this process.

This chapter reviews the status of living organisms and their habitats in the Maltese Islands. Living organisms, which include plants, animals, fungi, and bacteria, live in habitats of which Malta contains several of conservation value. These include cliffs, sand dunes, salt marshes, woodlands, garigue areas and coastal waters, but also agricultural and urban environments. These living organisms and the variety they represent are valuable not only in their own right, but also have a direct instrumental value to human society. They provide life-support systems, resources for fisheries and agriculture, and the environment for recreational, cultural, artistic and tourism-related activities. Despite its small size, Malta holds an interesting array of habitats and species.

The 1979 Birds Directive³⁷⁴ and the 1992 Habitats Directive³⁷⁵ form the backbone of EU biodiversity legislation. An EU Biodiversity Strategy³⁷⁶ was adopted in 1998, to align more closely EU biodiversity policy with the UN Convention on Biological Diversity. Under this strategy, in 2001, an initiative was adopted to halt the loss of European biodiversity by 2010. This 2001 initiative was followed by the EU Biodiversity Action Plan³⁷⁷ in 2006.

Despite the legal protection afforded to important habitats over the last 15 years, Malta's biodiversity continues to be threatened, principally by land development, invasive alien species, over-exploitation and climate change. With an area of 315km² and a population density of 1,298 residents per km² in 2007,³⁷⁸ Malta's land area is subject to strong pressures for building development, as land is required to provide for housing and other needs, but also because land is used for its investment value. Between 1990 and 2006, approximately 2.7km² (0.85 percent)³⁷⁹ of total land area, consisting of sclerophyllous vegetation, agricultural land and non-irrigated arable land, was converted to discontinuous urban fabric, industrial or commercial units, mineral extraction sites and dumping sites. Yet urban development occupies natural and agricultural land area needed for biodiversity to thrive. Indeed, although significant progress has been made in defining and protecting the most important Maltese habitats and species, the overall scale and pattern of development, and related activity such as transport and minerals extraction, continues to take its toll on biodiversity. In addition, species present in undeveloped areas also suffer the effects of land development due to changes in the environmental media such as air and water, and also since the overall land area in which they are found is further limited. Despite the overall success³⁸⁰ in constraining development³⁸¹ within the development zone³⁸² since 1988, the lack of alternative locations for certain uses such as waste treatment facilities, and the lack of large sites in single ownership within the development boundary, continue to place pressure for large new developments outside the development zone.³⁸³

Invasive alien species, which, when introduced outside their natural environment are capable of out-competing native organisms, can have serious socio-economic impacts. A local example is the recent introduction of the Red Palm Weevil (*Rhynchophorus ferrugineus* Maltese: Bumunqar ahmar tal-palm) through importation of infested palm trees (Plate 8.1) that affected palm trees across the Maltese Islands. **Alien species are therefore a serious threat to Malta's biodiversity, requiring the formulation of actions plans to eradicate them and to prevent further introductions.**

Plate 8.1: Red Palm Weevil



Genetically Modified Organisms (GMOs) are varieties formed when the genetic material of certain species is modified to confer, in most cases, an economically advantageous trait. Due to their potential to become invasive in the wild, hybridise with wild or cultivated relatives, or become toxic to other organisms, their use is highly regulated under national and EU legislation.³⁸⁴ Indeed, stringent approval procedures, including scientific risk assessment, are necessary before GMOs can be placed on the market. Malta's Biosafety Co-ordinating Committee (BCC) reviews and assesses applications for the contained use of GMOs. By end 2008, the BCC had reviewed 42 applications, all from EU countries other than Malta, to place GMOs on the market (17) and to import GM food and feed (25). Malta has also prepared a National Biosafety Framework and launched a Biosafety Clearing House, which is an information exchange portal.³⁸⁵ At European level, Malta has insisted on the need to protect fragile ecosystems, in particular small isolated islands, from possibly invasive GMOs.





The third threat to Malta's biodiversity concerns the exploitation of wildlife for food, research or private collection, which negatively affects wild populations if uncontrolled. It is estimated that uncontrolled exploitation has led to a number of extinctions and population reductions, although complete information is still lacking.³⁸⁶ Carnet de Chasse³⁸⁷ catch declarations provide an indication of the scale of wildlife exploitation in Malta. An annual average of 188,126 birds was hunted or trapped between 2002 and 2007, by an annual average of approximately 12,000 persons (some 16 birds per returned form), with the Turtle Dove (almost 40,000 birds per annum) and Song Thrush (almost 35,000 birds) being hunted or trapped in the greatest numbers.³⁸⁸ While declared catches are on the rise following awareness-raising among hunters of the importance of accurate statistics (total catch declared in 2007 rose by 80 percent over the previous year), the number of returned forms decreased by an average of 260 per year between 2002 and 2007.

Finally, it is now acknowledged internationally³⁸⁹ and in Malta³⁹⁰ that biodiversity is threatened by climate change, and that climate change will become the principal threat faced by biodiversity in the future: a 1°C warming in the Alps is predicted to result in a 40 percent loss of local endemic plants, while a 5°C warming would result in a 97 percent loss.³⁹¹ Many of the expected impacts of climate change in Malta,³⁹² related to water supply and quality, more frequent extreme weather events, increased desertification and soil erosion, and sea-level rise, are expected to affect biodiversity, directly or indirectly, particularly in the case of species that are slow to adapt to change.

Despite its small size, Malta hosts numerous species, with a substantial amount being endemic. The distribution and status of Malta's important habitats is of interest as these determine the status of the species within them. Malta's natural habitats are limited and confined to specific areas. Forest remnants are only found in a few localities and sand dunes have regressed over the years, with typical dune species becoming more threatened. Cliffs are chiefly found towards the North-Western and Southern parts of the islands and are particularly important for a number of endemic species,³⁹³ although cliff habitats are less threatened than other habitat types.

Some Maltese habitats and the species within them are important both nationally and at a European level. Table 8.1 provides a qualitative review of the status of selected groups of species, mostly based on assessments carried out in the context of Habitats Directive reporting.³⁹⁴ Charts 8.1 and 8.2 indicate the status of Maltese habitats and species listed in the Habitats Directive.³⁹⁵ These indicate that **the status of 29 percent of Maltese habitats and 36 percent of Maltese species listed in the Habitats Directive is still unknown**, of which a significant amount relate to the marine environment. **In addition, 64 percent of habitats and 44 percent of species have a bad or inadequate conservation status. Stringent measures are required for these to attain favourable status, while further surveys are needed to assess those with unknown status.**

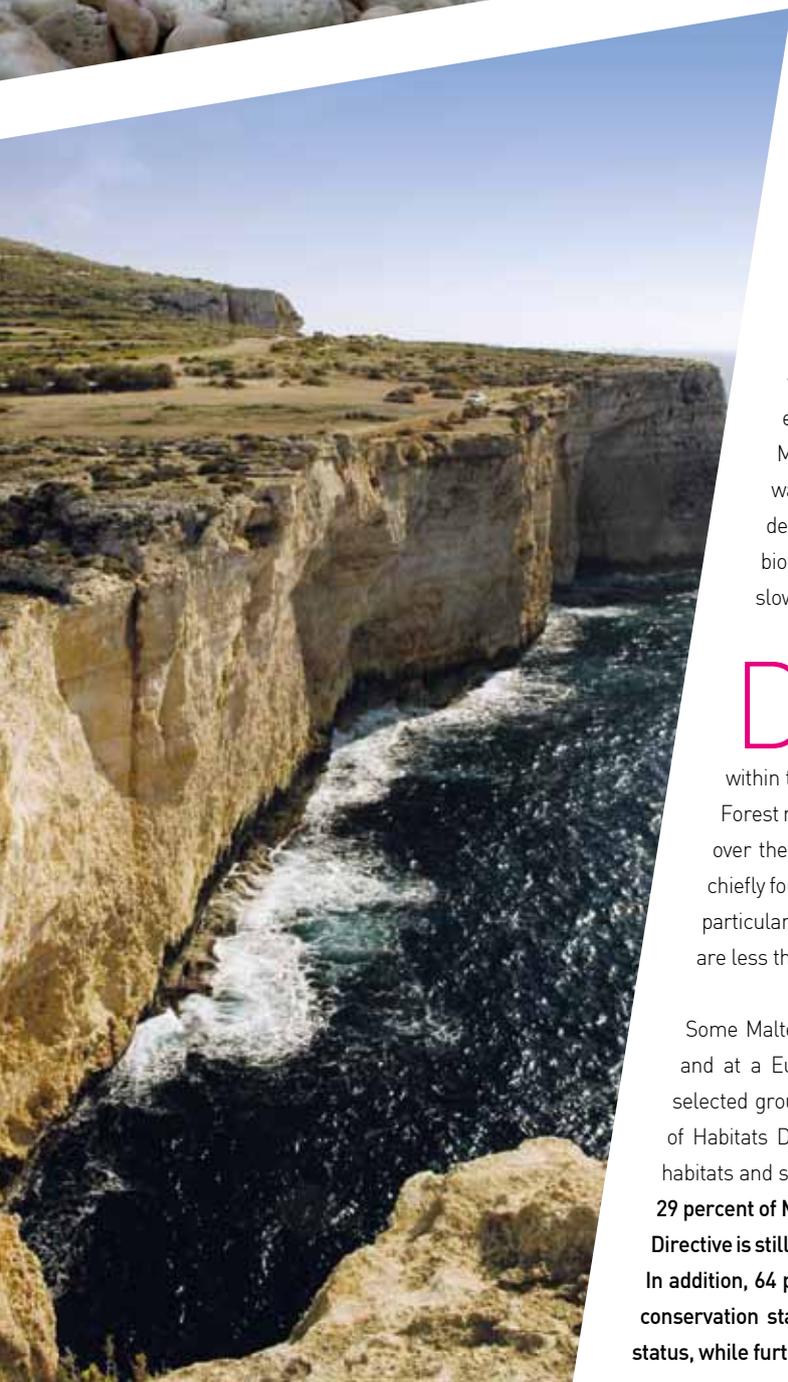


Table 8.1: Status of selected groups of species in the Maltese Islands

Plants: Out of 14 assessed terrestrial species, 13 have an unfavourable status. Of the latter, eight have an unfavourable - inadequate status and five have an unfavourable - bad status (one of these is possibly extinct prior to when EC Habitats Directive came into force in Malta, hence not considered in Chart 8.1). The status of the marine species could not be assigned in view of limited data.

Fungi: A detailed assessment of fungal diversity has not yet been carried out, and is urgently required. On the basis of existing information, it appears that many species are confined to a few areas, particularly forest remnants and selected garigue sites; however, a good number of such habitats are protected. Increased human disturbance in key areas is likely to be the principal cause leading to possible decline.

Mammals: Nine terrestrial and 12 marine species found in the Maltese Islands were assessed. The hedgehog and two species of bats are at a favourable conservation status, with four other bat species being at an inadequate status. The status for another bat species and for the Sicilian shrew is as yet unknown. The status of marine mammals remains unknown. One bat species and four cetaceans are considered occasional and hence not considered in Chart 8.1.

Amphibians and Reptiles: Only one amphibian, the Painted Frog (*Discoglossus pictus pictus*) is native to the Maltese Islands, with its status being inadequate and deteriorating. The eight species of Maltese terrestrial reptiles are all at a favourable conservation status, apart from one, this being the Selmunett Wall Lizard (*Podarcis filfolensis kieselbachi*), which is confined to the islands of Selmunett. The status of the Loggerhead Turtle (*Caretta caretta*), a marine reptile, in Maltese waters, is as yet unknown.

Fish: Only two fish species were assessed, the Mediterranean Killifish (*Aphanius fasciatus*) and the Mediterranean Shad (*Alosa fallax*). Whilst the Mediterranean Killifish has an unfavourable - inadequate conservation status, the status of the Mediterranean Shad is as yet unknown.

Invertebrates: Six terrestrial and six marine invertebrate species were assessed. The status of five of the terrestrial species is unfavourable, while it is unknown for another. The general status of marine species is unknown.

Birds: There was a decrease in the Blue Rock Thrush (*Monticola solitarius*) population in the last 20 years and the Corn Bunting (*Miliaria calandra*) continues to decline. In 2007, Barn Swallows (*Hirundo rustica*), Spotted Flycatchers (*Muscicapa striata*) and Woodchat Shrike (*Lanius senator*) bred successfully at Buskett while the Spectacled Warbler (*Sylvia conspicillata*), the Collared Dove (*Streptopelia decaocto*) and the Little Ringed Plover (*Charadrius dubius*) populations increased. The status of migratory birds may be considered as threatened due to illegal hunting.

Source: MEPA; Sultana & Raine 2008

Chart 8.1: Conservation status of habitats of European Community importance

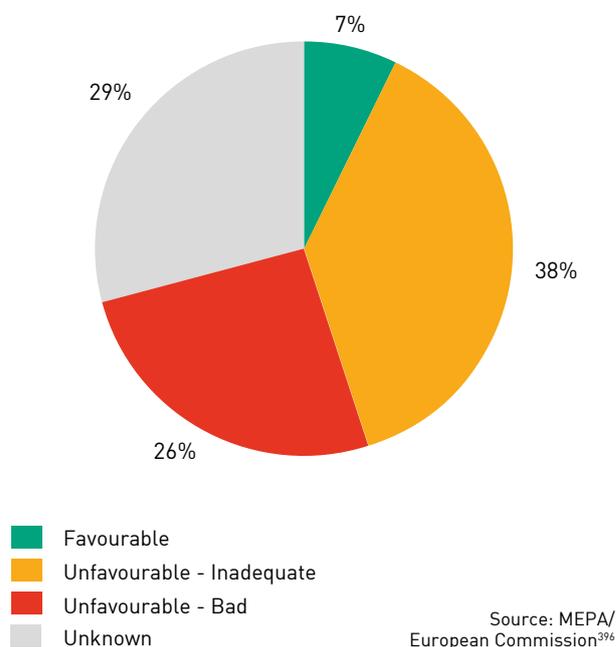
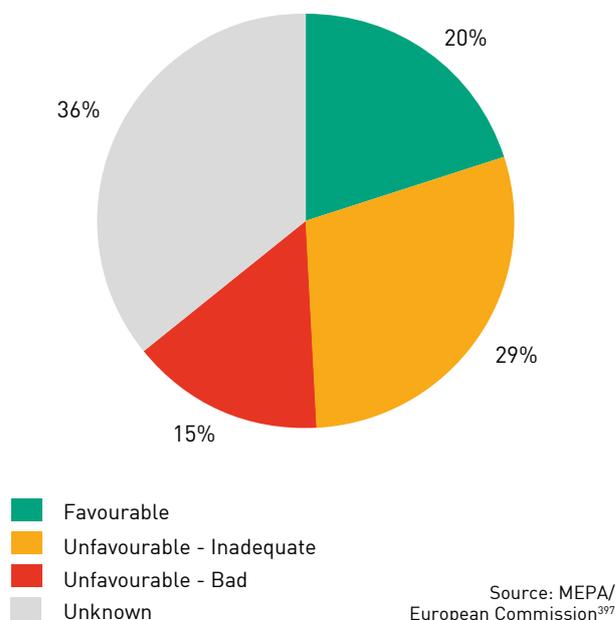


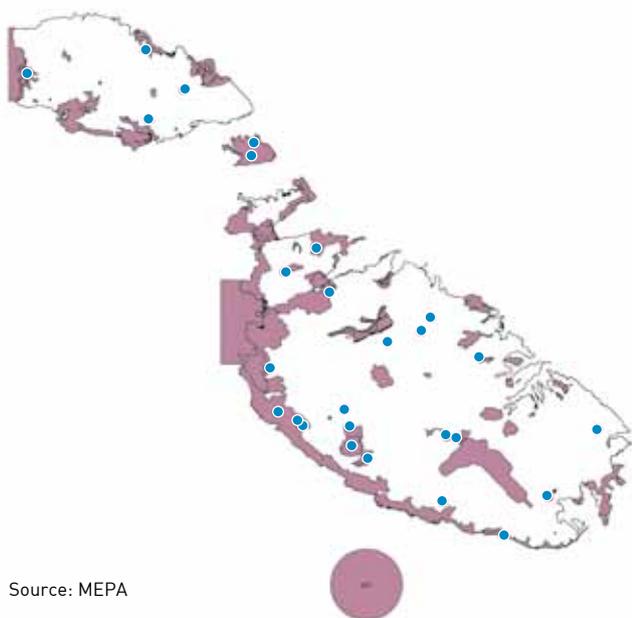
Chart 8.2: Conservation status of species of European Community importance



To address these concerns, national and international measures are being taken in the form of designation and management of protected areas. As of end 2008, 20.5 percent of Malta was covered by some form of statutory designation for the purposes of nature protection (Map 8.1). One additional Special Area of Conservation (SAC) was designated³⁹⁸ in 2008, bringing the total to 43. Terrestrial SACs occupied 13.3 percent of land area, while the two marine sites covered 11km² of territorial waters. In addition, Malta also had 13 Special Protection Areas (SPAs),³⁹⁹ occupying 16.34km² or 5.18 percent of land area. At this point, Malta also had three Nature Reserves affording protection to islets and 29 affording protection to trees, together with 26 Bird Sanctuaries.⁴⁰⁰ Furthermore all beaches and swimming areas in close proximity to urban areas or major roads, including 11 specifically named beaches, were afforded protection from hunting in 2007.⁴⁰¹ Under planning legislation,⁴⁰² Malta had 43 Areas of Ecological Importance and/or Sites of Scientific Importance as of end 2008.

Several areas of international importance have also been designated as Natura 2000 sites.⁴⁰³ The sites concerned can be designed either for their general ecological importance as SACs, or particularly for their importance for birds (SPAs), and these two can overlap. **As of end 2008 Malta had designated 27 terrestrial SACs of 41km² (13.06 percent of land area), one marine SAC of 8.5km², and its 13 SPAs⁴⁰⁴ in the Natura 2000 network.** Indeed, as of June 2008, **Malta had almost reached sufficiency with respect to the proportion (93 percent) of habitats and species for which an adequate number of terrestrial Natura 2000 sites have been proposed under the Habitats Directive.**⁴⁰⁵

Map 8.1: Areas designated for the protection of biodiversity



■ Designated areas (nature reserves, bird sanctuaries, special areas of conservation, special protection areas, areas of ecological importance, sites of scientific importance).

In addition to legal designation, effective protection of species requires the active management, on the basis of management plans and agreements between parties, of protected sites. **Management of protected areas**, which is carried out through the implementation of a management plan drawn up specifically for a particular area, **is being addressed by Government and by MEPA in partnership with non-governmental organisations. Structural funding has been allocated to accelerate this process.** As at end 2007, seven areas at Ghadira, Simar, Ghajn Tuffieha, Qawra/Dwejra, Xrobb l-Ghagin, Wied Ghollieqa, and Ramla l-Hamra were being managed by NGOs based on a management plan. Five of these areas are part of, or entire SACs, such that 3.5 percent of SACs were being managed subject to a management plan. Management plans for four other areas, at il-Ballut ta' Marsaxlokk, Pembroke, Ramla tat-Torri and Rdum tal-Madonna, were being developed or undergoing review. Management for three islets, which are fully or partially SACs, is afforded through specific legislation restricting site access.⁴⁰⁶ As of end 2008 management plans for the Pembroke Natura 2000 site and Ir-Ramla tat-Torri (part of a Natura 2000 site) had been submitted to MEPA for review, and the plan for the Rdum Majjiesa/Ras ir-Raheb area was in progress. In parallel, various activities by a number of agencies contribute to the administrative, statutory or contractual management of some 22 sites.⁴⁰⁷ Management actions include regular monitoring and research, enforcement, habitat restoration, interpretation, awareness-raising and education, organic farming and the laying of walking paths.

Besides such designation and management measures, complementary activities have an important role. These activities include the use of licensing⁴⁰⁸ and permitting⁴⁰⁹ systems, as well as conservation initiatives focussing on particular species, such as the eradication of invasive alien species⁴¹⁰ and the conservation⁴¹¹ and re-introduction⁴¹² of important species. They also include agri-environmental measures promoting organic farming and rubble wall conservation,⁴¹³ development of a national biodiversity database and international indicators,⁴¹⁴ awareness-raising; and, importantly, the preparation of a National Biodiversity Strategy and Action Plan.⁴¹⁵ Nevertheless, **further baseline studies and monitoring are necessary in order to address the threats faced by species and habitats of importance in the Maltese Islands.**





CHAPTER 9

ENVIRONMENTAL

HEALTH

KEY MESSAGES:

- » Malta's principal environmental health challenges are respiratory diseases that may be related to air pollution. Noise is also an area of potentially significant environmental health impact, although there is as yet little public awareness of its effects on human health.
- » In order to better understand the relationship between environment and health in Malta, there is a need to develop an environmental health information system based on integrated health and environmental data and bio-monitoring.
- » Most environmental health issues originate in other sectors, and there is therefore need for an augmented inter-sectoral approach to finding and implementing policy solutions.
- » In order to ensure the implementation of the EU Thematic Strategy on pesticides in the Maltese context, there is likely to be a need for a national policy on the sustainable use of pesticides.
- » The importance of education in raising awareness on the link between environment and health has to date been underestimated. Preventative measures should also be highlighted; these should include exercise and healthy lifestyles, as well as the provision of urban green space and other recreational facilities.

Environmental health refers to aspects of human health and diseases that are directly affected by environmental quality. A fundamental pre-requisite for environmental health is therefore the protection of the health of the natural systems that sustain human life. After a brief review of the policy context, this chapter reviews environmental health issues relating to air, radiation, water and chemicals, as well as the emerging environmental health issues associated with noise, climate change and land-use patterns.

As part of the WHO-led European Environment and Health Process,⁴¹⁶ a Children's Environment and Health Action Plan for Europe (CEHAPE) was adopted at the Fourth UNECE Ministerial Conference on Environment and Health in 2004. The CEHAPE focuses on four priority goals: morbidity and mortality related to water and sanitation; accidents and injuries; outdoor and indoor pollution; and, chemicals and other hazardous agents. Environmental health is also highlighted in the EU Sixth Environment Action Programme,⁴¹⁷ and public health is one of the seven priorities in the renewed EU Sustainable Development Strategy of 2006.⁴¹⁸ At a national level, Malta has also prepared a National Environmental Health Action Plan (NEHAP), which is in the process of being updated. The revised NEHAP focuses on the two CEHAPE priorities most relevant to Malta: outdoor and indoor pollution, and accidents and injuries.⁴¹⁹

Air pollution is a major determinant of environmental health, and arises from sources including road transport, power stations, incinerators not meeting the required standards, landfills, construction sites, and quarrying. Current air pollution levels in Europe are responsible for a significant burden of deaths, hospital admissions and aggravation of symptoms, especially in relation to cardio-respiratory disease.⁴²⁰

The principal air pollutants in Malta are PM, O₃, NO₂, SO₂ and benzene.⁴²¹ In Malta, between 2006 and 2007, annual average SO₂ concentrations increased, while maintaining the overall decreasing trend since 2004 following the introduction of low-sulphur fuels. Annual average NO₂ and benzene concentrations increased but remained below EU limit values. Values for PM and O₃, however, exceeded EU standards and were at levels that raise concerns for human health. The main source of atmospheric O₃ is transboundary, and solutions for this problem may be particularly difficult.

Indoor air pollution arises from outdoor air pollution, materials and products such as building and construction materials, furnishing, paints and consumer products,⁴²² as well as certain domestic activities, the most significant of which is smoking. Environmental tobacco smoke is the most significant indoor air pollutant across Europe, and chronically-exposed adults have increased risk of death and illnesses from cancer and cardiovascular respiratory diseases. In 2006, 25 percent of the Maltese population aged above 15 years smoked, seven percent below the EU25 average.⁴²³

There is little documented direct evidence of air pollution-related disease in Malta, although the 2001 International Study on Asthma and Allergies in Children indicates that childhood asthma rates increased from 7.5 percent in 1994 to 14.8 percent in 2001. Updated data is urgently required in order to monitor this trend. In addition, recent joint monitoring⁴²⁴ of traffic counts, air quality, and levels of respiratory disease in child populations suggests that high concentrations of NO₂ are significantly associated with an increase in prevalence of wheezing in school children.

Radiation, which consists of energy emitted by atoms in the form of particles or electromagnetic rays,⁴²⁵ constitutes another environmental health hazard. Radiation can be ionising, having enough energy to break chemical bonds (which is carcinogenic), or non-ionising. Approximately 40 percent of ionising radiation comes from radon gas,⁴²⁶ which is naturally present to various extents everywhere on the Earth's surface and which may accumulate in buildings. The European guideline values⁴²⁷ are 400Bq/m³ for existing houses and 200Bq/m³ for future dwellings. Initial surveys in Malta have indicated a geometric mean of radon at 40Bq/m³,⁴²⁸ which falls below the internationally recommended action levels.

There are two types of non-ionising low-frequency electromagnetic fields (EMF) that can affect human health: extremely low frequency fields emitted from electrical and electronic equipment and power lines; and radiofrequency radiation from mobile phones, Wi-Fi networks, cordless phones, and transmission towers.⁴²⁹ Prolonged exposure to EMF in indoor environments may increase risk of respiratory diseases and infections from small airborne particles.⁴³⁰ There are also concerns about current limits regulating how much EMF radiation is allowable from power lines, cell phones, and other sources of daily EMF exposure.⁴³¹ In this respect, regular studies are being carried out by the WHO⁴³² and the EU⁴³³ in order to closely follow new developments in scientific research on the potential health effects of EMF. Non-ionising radiation falls under the remit of the Malta Communications Authority, which regularly monitors EMF.⁴³⁴

Ultraviolet (UV) radiation is part of the solar electromagnetic spectrum, and overexposure to UV radiation causes certain types of skin cancers, cataracts and immune deficiency disorders.⁴³⁵ This underlines the importance of protecting the ozone layer present in the stratosphere, which filters this UV radiation and prevents much of it from reaching the Earth.⁴³⁶

Access to water, of adequate quantity and quality, is another major determinant of environmental health. However, rather than availability, Malta's water-related environmental health concerns relate more to water quality. Although there are quality issues related to Malta's groundwater bodies, in terms of contamination with nitrates from intensive horticulture and animal breeding,⁴³⁷ the possibility that this water causes environmental health problems depends on the subsequent quality of drinking water, whether this is from the main provider, WSC, or from privately-owned boreholes.



The Drinking Water Directive⁴³⁸ addresses the quality of water intended for human consumption. In this context, the WSC ensures that all water leaving its plant conforms with required standards. Results from WSC's Routine Monitoring Programme,⁴³⁹ which tested 5,818 samples in 2007,⁴⁴⁰ indicated that exceedences were mostly microbiological and due to sampling point errors, or to temporary failures due to water distribution system works. The mandatory⁴⁴¹ Audit Monitoring Programme on water samples from customers' households indicates that although for the year 2006/07 one exceedence was registered for nitrates, in the Qormi zone, it was corrected within one week of occurrence. Malta met its deadline of December 2005 for meeting the 50mg/l limit of nitrates in drinking water, primarily by blending groundwater with desalinated water.⁴⁴²

The only exceedences in 2006/07 to the guideline (i.e. non-mandatory) limits related to chloride and sodium levels (although these were less than in 2005/6), which are naturally occurring in Malta's environment, and are included in the legislation due to concerns about taste rather than human health. These results however indicate the high levels of salinity in groundwater bodies, which are threatened by over-abstraction and saltwater intrusion.⁴⁴³ The presence of selected pesticides was also investigated as required by the regulations, but no exceedences were recorded. The findings concerning high levels of iron are related to the use of iron mains piping, which is now being replaced.

Private water supplies intended for human consumption also need to conform to standards.⁴⁴⁴ Suppliers are required to provide microbiological and chemical analysis results for each source of water in order to become officially registered in line with regulations.⁴⁴⁵ As at December 2008, 23 suppliers with 22 sources⁴⁴⁶ had registered.⁴⁴⁷

Bathing water quality is also an important factor for environmental health, due to the risk of ill-health associated with contact with polluted bathing waters. Malta's bathing waters were 99 percent compliant with EU standards in 2008.⁴⁴⁸ Besides these more traditional pollution concerns, new issues are emerging in relation to contamination of waters with chemicals such as heavy metals and persistent organic pollutants (POPs) (see below). These issues can only be properly addressed through environmental permitting of operators and installations using these substances.

Many environmental health issues arise out of the misuse and poor collection and treatment of hazardous chemicals, which pass into the environmental media of the air, water, and soil and lead to contamination. There is growing concern that even low-level exposure to a complex cocktail of pollutants can have considerable effects on human health,⁴⁴⁹ notwithstanding long time-lags between exposures and health effects.⁴⁵⁰

POPs, a family of organic chemicals that resist photolytic, biological or chemical degradation, bio-accumulating in the food chain, are of particular concern.⁴⁵¹ These chemicals include certain pesticides, such as dichlorodiphenyltrichloroethane (DDT), industrial chemicals, such as polychlorinated biphenyls (PCBs), and unintentional by-products of industrial processes, such as dioxins and furans.⁴⁵² As POPs can be transported over long distances in the atmosphere they are often found in places where they have never been utilised.



Although dioxins and dioxin-like compounds, including furans and PCBs, are possibly the group of POPs having the lowest safety margin,⁴⁵³ the risk of exposure is not expected to be high in Malta, given the almost complete absence of open grazing and heavy chemical industry. In 2007, Malta's Release Inventories for Dioxins and Furans⁴⁵⁴ estimated that emissions of dioxins/furans in air were 130.5g I-TEQs per million inhabitants in 2005. The study identified 12 POP contamination hotspots in the Maltese Islands, mainly landfills, obsolete incinerators, the Malta Shipyards and certain quarries.

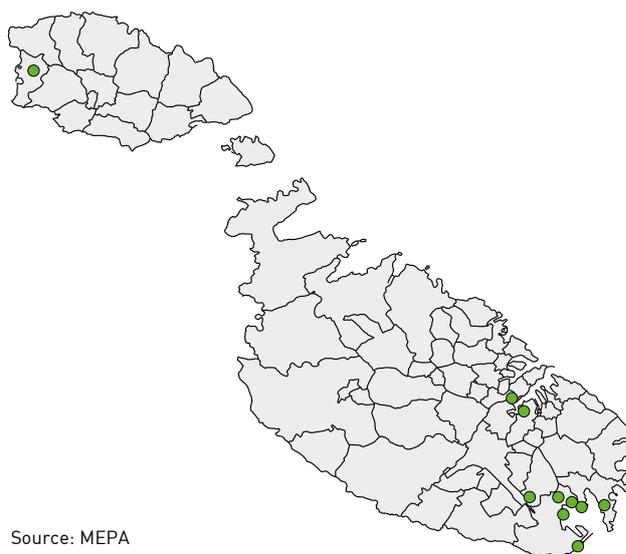
Heavy metals are another set of pollutants that bio-accumulate in the food chain and are therefore of concern for health. Lead, a widely recognised health hazard,⁴⁵⁵ reaches populations from various sources including leaded petrol, industrial processes, paint, solder in canned food, and lead water pipes. The Maltese population is known to have had high levels of lead in blood during the 1980s and 1990s, however since a number of actions were taken,⁴⁵⁶ adult mean blood levels taken in 2002 and 2005 have dropped from an average of 72µg/l to 59µg/l respectively.⁴⁵⁷ With respect to lead concentrations in air, as noted in Chapter 2, samples taken over a two-year period from early 2007 to early 2009 indicate that concentrations are well below the 500ng/m³ EU limit value. However, between 2002 and 2006, the average lead content in soil in monitored sites increased from 78 milligrams per kg (mg/kg) to 125mg/kg.⁴⁵⁸ Preliminary data exists for other heavy metals of concern, including cadmium, mercury, chromium and nickel. In Malta samples collected between November 2007 and April 2009 indicated that only nickel at Kordin exceeded the lower assessment threshold of 10ng/m³, with 10.7ng/m³. Arsenic and cadmium were below EU limit values everywhere. Measures are being taken to ensure that all dental chairs are, eventually, either replaced or fitted with dental amalgam separators through a phased approach. Furthermore, checks regarding proper disposal will be carried out. Mercury could become more significant in view of the increased use of energy-saving lamps, many of which contain mercury. Nevertheless, implementation of the Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) Regulation's⁴⁵⁹ provisions on marketing restrictions should help to reduce exposure to these chemicals.

Pesticides and biocidal products are commonly used, particularly in farms, homes, schools, public gardens and hospitals. However exposure to pesticides may lead to negative health effects, depending on dosage and length of exposure.⁴⁶⁰ Maltese and imported crops are regularly monitored for pesticide residues: between 2002 and 2007, 117 out of 339 samples were found to have residues (mostly peaches and strawberries), although not all exceeded the maximum residue levels stipulated by the EU.⁴⁶¹ The EU Directive concerning the placing of plant protection products on the market⁴⁶² defines strict product authorisation rules, while **the 2006 Thematic Strategy on the Sustainable Use of Pesticides⁴⁶³ provides a framework to minimise risks related to pesticide use. There is likely to be a need for this**

Strategy to be translated into a national policy for the sustainable use of pesticides.

The EU REACH Regulation⁴⁶⁴ and the SEVESO II Directive,⁴⁶⁵ aim to better protect human health from chemical risks. Under REACH, manufacturers and importers of over one tonne of substances made or bought in the EU have to register their substances with the European Chemicals Agency. An authorisation system will ensure that substances of very high concern are adequately controlled and gradually substituted by suitable alternatives or only used if they have an overall benefit for society. The SEVESO II Directive regulates installations with the potential to cause major accidents. As of December 2008, there were six upper tier and four lower tier⁴⁶⁶ SEVESO establishments in Malta, and the substances stored at the facilities are primarily petroleum fuels, petrol, kerosene, diesel and fuel oils (Map 9.1). Related planning guidance was published in 2005.

Map 9.1: SEVESO II sites



Source: MEPA

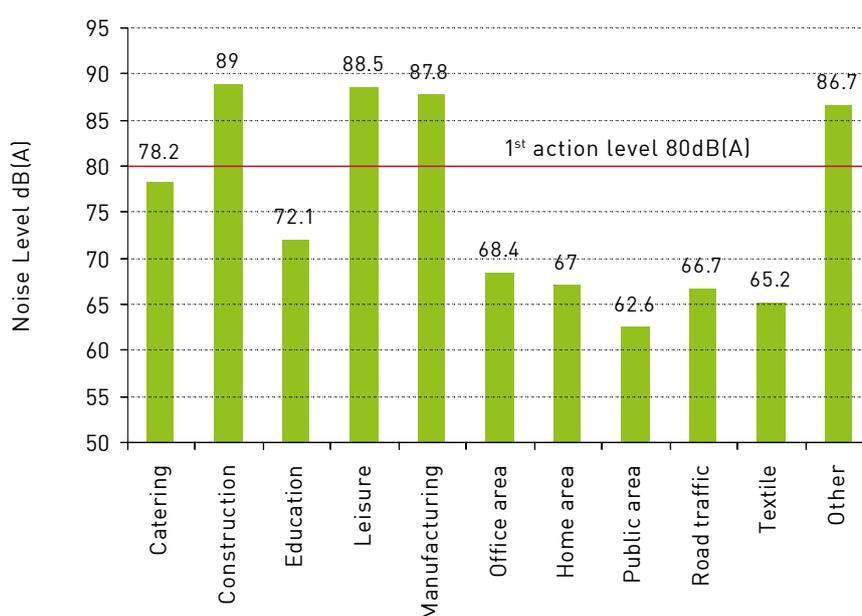
As awareness grows about the relationship between the environment and health, new environmental health concerns are emerging related to noise, climate change and land use patterns. Noise is a known health hazard, interfering with daily activities at home, work, school and during leisure time,⁴⁶⁷ and has become one of Europe's principal environmental issues,⁴⁶⁸ as **it is an area of potentially significant environmental health impact.** While the overall burden of noise-related ill health in Europe remains unquantified,⁴⁶⁹ approximately 20 percent of the EU's population suffers from noise levels that are considered unacceptable, and there is as yet little public awareness of its effect on human health (Table 9.1).⁴⁷⁰ Noise in the vicinity of airports is also of concern.⁴⁷¹ In 2005 the Occupational Health and Safety Authority carried out a study that provided baseline data on peak noise levels from various activities, areas, locations and sectors (Chart 9.1)

Table 9.1: A selection of guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	L_{Aeq}^{472} [dB(A) ⁴⁷³]	Time base [hours]	L_{Amax}^{474} fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons: <5 times a year)	100	4	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults)	-	-	140 ⁴⁷⁵
	Hearing impairment (children)	-	-	120 ⁴⁷⁶

Source: WHO

Table 9.1: Sector noise level averages dB(A)



Source: OHSA

Climate change is also currently contributing to the global burden of disease and premature death.⁴⁷⁷ Temperature increases (which will also aggravate effects of air pollution on health)⁴⁷⁸ and longer periods of intense heat are probably the greatest concerns for Europe.⁴⁷⁹ Climate change will affect human health in Malta in mostly adverse ways,⁴⁸⁰ mostly due to extreme events, particularly more severe heat waves. Increased thermal stress will cause deleterious health effects particularly for vulnerable groups such as the aged and infirm. Other health effects are expected from increased risk of toxic algal blooms and the spread of some vector-borne diseases such as malaria and food-borne diseases. These predictions were underlined in a 2009 Conference on Health Effects of Climate Change.⁴⁸¹ Adaptation measures⁴⁸² already taken include awareness-raising initiatives on the negative effects of heat (including daily publication of heat stress and UV indices), and salmonellosis related to food hygiene; construction of three sewage treatment plants;⁴⁸³ and, vaccination against vector-borne diseases for travellers to or from affected zones.

It is increasingly recognised that healthy lifestyles are the best way to prevent disease and premature death.⁴⁸⁴ One stark reminder of this is the growing worldwide concern over obesity.⁴⁸⁵ In 2002 68 percent and 49 percent of all males and females respectively in Malta were reported to be pre-obese or obese.⁴⁸⁶ Furthermore, a 2007 study indicated that over 25 percent of school-entry children were overweight or obese⁴⁸⁷ while in 2001/02 Malta's 13 and 15-year-olds ranked highest in prevalence of excess body weight (including obesity) in Europe. In 2005/2006, 31 percent of both girls and boys aged 13 years, and 28 percent of girls and 32 percent of boys aged 15 years, were found to be overweight or obese.⁴⁸⁸ For both girls and boys in both age categories (except for 13 year old boys) the proportion of overweight and obese adolescents increased since 2001/2.⁴⁸⁹

In order to counteract obesity, regular exercise and recreation in healthy environments are essential,⁴⁹⁰ which necessitates public access to areas where such activities can take place. Land use planning has a role in ensuring such access, through positive planning measures to protect and enhance public open space.⁴⁹¹ It also has a role in encouraging alternative modes of transport to the private car, by discouraging extensive land development patterns characterised by separation of land uses for different purposes.

This summary has reviewed the major environmental health issues in Malta, indicating that **Malta's most significant environmental health challenges are respiratory disease that may be related to air pollution.** In many of these areas, the links between ill-health and environmental change have not been conclusively proven. **This points to the need for more resources to be allocated to research into the relationships between human health and environmental change, and particularly for the development of an integrated health and environment information system, including the use of bio-monitoring.** In this respect, **an inter-sectoral approach to finding and implementing environmental health policy solutions is crucial.** Finally, **the importance of education in raising awareness of the link between environment and health has to date been underestimated.** Preventative measures should also be highlighted; these should include exercise and healthy lifestyles, as well as the provision of urban green space and other recreational facilities.





CHAPTER 10

RELATIONSHIPS BETWEEN THE NATURAL ENVIRONMENT AND ECONOMIC ACTIVITY

KEY MESSAGES:

- » The environment is a crucial contributor to the Maltese economy: it is directly used to produce around one-fifth of employment and one-sixth of value added, while also providing amenities for recreation, residence and location of economic activity and absorbing the by-products of production and consumption.
- » Activities dependent on direct extraction of environmental resources tend to be labour-intensive, and are growing relatively slowly. A more sustainable economy will need to develop sectors that are less dependent on direct use of environmental resources.
- » Land is one of the key resources for Malta's economy: consumption of residential services is equivalent to over one-fifth of household consumption based on market transactions, while the accumulation of value of vacant properties amounts to over one-third of the total savings of the economy.

Economic activity is one of the prime drivers of environmental change, as discussed in Chapter 1 of this Report. However, the environment is also a fundamental resource base for economic activity, providing great benefit for the economy and society. Importantly, as indicated in other chapters of this Report, there are positive signs, which, if maintained, could be considered to indicate the relative⁴⁹² decoupling of economic activity from certain forms of environmental damage, such as GHG emissions.

The focus of this chapter is to present a clearer understanding of the inputs provided by the natural environment into economic activity, an understanding that is crucial for policymakers.⁴⁹³ The economic sphere also provides opportunities for states to use economic tools to address environmental issues, and these considerations are taken up in the next chapter on Policy Responses.

The aim of economic activity is to produce human welfare through the interaction of society with the resources available to it. Chief amongst the resources available are those in the natural environment.⁴⁹⁴ This chapter provides quantitative assessments of the value of the environment for economic activity where this is possible, complemented by qualitative approaches and recommendations for further study where data is insufficient.

The type of interaction between human welfare and environmental resources may be categorised in terms of Source, Sink and Support functions as follows:⁴⁹⁵

- » Source values are categorized as emanating from: (a) activities involving the direct and indirect use of resources, e.g. the extraction of minerals, agriculture, fishing, enjoyment of beaches, etc and; (b) non-use of environmental resources, mainly the welfare created by the knowledge of the existence of environment assets of which no use is being made;
- » the Sink value, with the environment acting as a sink to absorb and transform harmful by-products of economic activity such as waste and pollution;
- » the environment acting as a life-Support system, for example as living space.⁴⁹⁶

In what follows, an evaluation of the environment's Source, Sink and Support functions for the Maltese economy is provided, based, where possible, on quantitative indicators. This is carried out in the knowledge that the study of the economic dimensions of the environment is still incipient in Malta and quantitative measures in this field are as yet being developed. This chapter therefore reports data that is not part of a consistent and coherent statistical system but is derived from a number of direct and indirect sources, of variable reliability, and based on a number of high-level assumptions, to provide a high-level indicative estimate of the phenomena being studied. In view of this, the figures need to be interpreted with caution and noted only as

indicative. In addition, since the estimates may contain an element of overlap and are not exhaustive, they cannot be aggregated.

The environment's Source function may be valued on the basis of both its use and non-use values. Beginning with an assessment of resource use activities for the purpose of production and direct consumption, these may be viewed from the following perspectives: use associated with market or non-market transactions; renewable or non-renewable resources; and, option use value or bequest value.⁴⁹⁷ In attempting to assess use values associated with the environment's Source function, information availability restricts this study to considering only the following aspects:

- » use of resources obtained *through market* transactions for *production* purposes, split between renewable and non-renewable resource use;
- » use of resources for *household consumption* purposes obtained *outside* market arrangements;
- » use of resources for *household consumption* purposes obtained *through* market transactions.

Beginning with resource use *through market transactions*, a partial estimate of the value of the environment as a Source may be obtained by considering the GDP of sectors the output of which depends on the use of Maltese environmental resources. These sectors include agriculture, fishing, water production and tourism, all of which utilise renewable resources. All of these use resources in a directly extractive manner, except for tourism, which depends upon the use of resources such as beaches and heritage, apart from land utilised to develop tourism facilities. Other sectors, which however utilise *non-renewable* resources, are quarrying, construction and real estate.⁴⁹⁸

Between 2005 and 2007, the value added produced and employment generated by the sectors of activity that make a direct use of environmental resources in Malta, accounted on average for 16.6 percent of economic activity (value added) and 19.7 percent of employment.⁴⁹⁹ Approximately one half of this originated from tourism, while construction accounted for another one fourth. Overall, it may be concluded that, subject to the limitations already noted, the direct use of environmental resources that have a market price generate almost one-sixth of the total value added in Malta. These sectors contribute directly to economic growth: between 2005 and 2007 this contribution amounted to 6.1 percent of total value added. However the sectors contributed 13.7 percent of total



employment growth, since they are typically labour-intensive. Thus, **activities dependent on direct extraction of environmental resources tend to be labour-intensive, and are growing relatively slowly. A more sustainable economy will need to develop sectors that are less dependent on direct use of environmental resources.**

The above review indicates how **the environment is a crucial contributor to the Maltese economy: it is directly used to produce around one-fifth of employment and one-sixth of value added, while also providing amenities for recreation, residence and location of economic activity and absorbing the by-products of production and consumption.**

The second perspective through which to quantify use values associated with the environment's Source function is from that of *resources used for household consumption outside market arrangements*. The principal form of this type of resource use relates to the utilisation, free of charge, of environmental assets for the purposes of recreation. These mostly relate to bathing sites, and other coastal or countryside locations (see Box 10.1).

Box 10.1: Monetary value of beaches at Pretty Bay and Ramla

Monetary value of beaches at Pretty Bay and Ramla

Two post graduate dissertations have attempted to place a monetary value on the beaches at Pretty Bay in Birżebbuġa⁵⁰⁰ and Ramla Bay in Gozo,⁵⁰¹ principally through willingness-to-pay surveys. These studies found that respondents were on average willing to pay €1.4 and €1.6 per visit to Pretty Bay and to Ramla Bay, respectively, and given that the numbers of annual visits to these beaches were approximately 285,000 and 265,000 visits respectively, this implies an annual value⁵⁰² of approximately €400,000 and €420,000 respectively per annum. However due to the small size of the sample (100) these results should be interpreted with caution.

When extended to the entire coastal shore length used for bathing, the total annual value generated by the willingness-to-pay to visit bathing areas would total approximately €6 million per annum.⁵⁰³ Once again, caution is recommended when using these results.⁵⁰⁴ These studies also provided a figure for total capital economic values of these beaches, which, extended to all bathing areas would amount to a total capital economic value of almost €550 million. It is also possible, based on a series of assumptions, to estimate the value of environmental amenities visited outside the summer period. Based on these assumptions, the total annual value generated by the willingness-to-pay can be estimated at €1.7 million. The total annual value generated by the willingness-to-pay by households for recreational purposes outside market arrangements, considering beach and countryside visits, would be approximately €7.7 million. However, as noted earlier, the high-level assumptions and small sample sizes involved in these assessments mean that the figures need to be interpreted with caution. It is important to stress that this argument is solely theoretical and intended to explore the value of recreational areas in monetary terms. It by no means suggests that users of such amenities should pay for their use.

A third and final perspective, albeit partial,⁵⁰⁵ for assessing the use value of the Maltese environment's Source function is through resource use for human consumption through market transactions.⁵⁰⁶ This leads to particularly interesting conclusions in the case of housing: on the basis of the existence of 192,000 properties⁵⁰⁷ in 2005, at an average price of €98,000,⁵⁰⁸ an indicative estimate for the economic value of the housing stock is €18.8 billion. Considering a five percent discount rate⁵⁰⁹ in the capitalisation of this asset, the annual stream of services emanating from this stock is approximately €935 million.

Due to the existence of vacant housing (approximately 53,000⁵¹⁰ units in 2005), the part of this stream that can be attributed to consumption of residential services may be estimated at approximately €675 million in 2005. This is equivalent to 22.5 percent of household consumption based on market transactions. The income stream associated with the vacant housing stock is estimated at €260 million. This is a form of saving and wealth accumulation for the owners of the vacant housing stock, which compares with a total reported saving of €700 million in 2005.⁵¹¹ Therefore, the accumulation of value of vacant properties is equivalent to 37 percent of the total savings of the economy.

Since, as indicated above, consumption of residential services is equivalent to over one-fifth of household consumption based on market transactions, while the accumulation of value of vacant properties amounts to over one-third of the total savings of the economy, it is evident that land is one of the key resources for Malta's economy. At the same time, this high figure raises questions about the economic and environmental efficiency of current housing markets. More efficient use of land and property would reduce pressure on land resources, and an integrated set of measures, including some from the planning system, is needed to address this issue. Once again, however, it is to be emphasised that these results can only be seen as indicative as they are based on various assumptions and estimates.

The environmental Source function in the Maltese economy also involves *non-use* values, i.e. human welfare generated by the existence of environmental resources without one having to have used these resources, by their bequest value, and by their option value.⁵¹² Since these values are expressed outside of the market system and official statistics, they must be explored through specific resource-oriented studies. The Pretty Bay study noted earlier estimates the non-use capitalised value of this site in a range between €1.3 million and €6.7 million. Extrapolating this valuation for all recreational environmental resources in Malta,⁵¹³ the aggregate value would be in a range between €34 million and €173 million. Assuming a five percent capitalisation rate, this would imply an annual flow of welfare generated in the range of 0.03 percent and 0.2 percent of GDP on a per annum basis. Once again, these estimates are based on broad assumptions and are only indicative, so more detailed studies are recommended.

The environment's Sink function in the economy, without which virtually no production and consumption activity could take place, involves the absorption or conversion of waste and emissions from economic activity in a manner that neutralises their negative effects on human welfare. Although the estimation of the contribution of this environmental function to economic activity, due to its all-encompassing nature, would seem superfluous, an estimate of its economic importance can be derived through approaches that internalise or monetize the costs of undertaking this function. This would give an indication of the amount of resources which must be expended by the economy in order to perform the Sink functions that the environment would be performing for free. It would also give an indication of the likely costs that would be incurred if, through unsustainable management of emissions and waste, the environment would be no longer able to properly perform this Sink function.

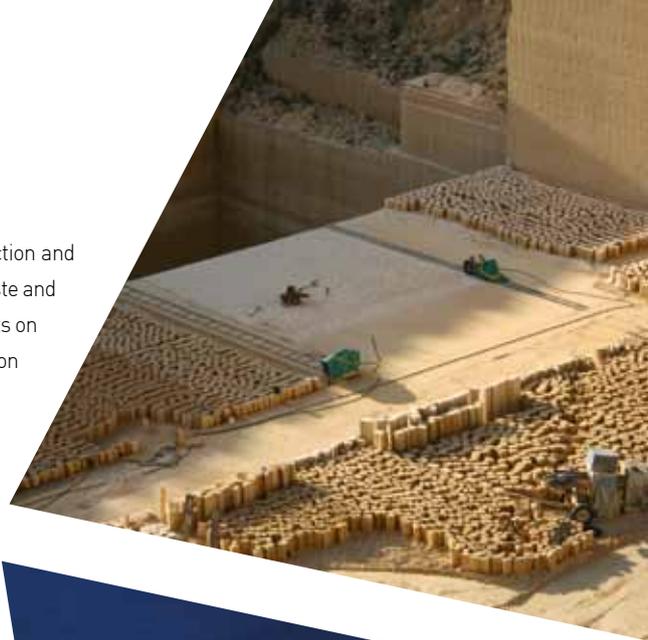
A partial indication of this can be derived from the amount of public expenditure directed for waste management, including liquid waste. This amounted to approximately €72.2 million, or 1.3 percent of GDP, in 2007⁵¹⁴ and reflected not only the management of waste on a recurrent basis, but also expenditure effected so as to allow a better environmental absorption of such waste, particularly through engineered landfilling, waste recycling and waste water treatment. The partial nature of this estimate, which omits not only certain waste management costs, but also those related to air, soil and water pollution, points to the need for more comprehensive assessment.

The third important dimension of the contribution of environmental resources to economic activity is the Support aspect. Since environmental resources provide the basic requirements for life, health and well-being, without which no economic activity could take place, the economic estimation of this effect would also seem superfluous. However, some interesting economic facets of this dimension may be explored because they highlight important aspects of the interaction between the economy and the environment. These relate mainly to the economic costs being incurred because of the inadequacy of environmental life-support systems. These would include, amongst others:

- » the additional costs of health-care and loss in economic output due to environmental problems, including the need for sick leave related to health issues such as respiratory diseases, etc.;
- » the additional costs involved in transforming economic resources to make them suitable for human use due to problems in the environment caused by human activity (e.g. water purification);
- » the costs to human welfare arising from the loss of natural habitat and landscapes.

The estimation of these, and other costs, would provide an indirect way of measuring the benefits of the Support function of the environment. However, in order to obtain a fair estimate of environmental impacts, it would be essential to identify the proportion of such costs that are due to environmental causes. This further demonstrates the complexity of the issues involved in obtaining suitable estimates of this kind, and again, further research is recommended.

This chapter has provided a brief and preliminary overview of the relationship between the environment and economic activity, indicating the various ways in which the environment underpins economic activity in the Islands, and providing quantitative assessments where possible. Due to lack of information in this area, it is recommended that further studies are undertaken to provide better estimates of factors such as the full environmental costs of resources used in production, willingness-to-pay for use and non-use of environmental amenities, the Sink function related to absorbing waste and pollution, and the full value of the environmental Support function.





CHAPTER 11

POLICY RESPONSES

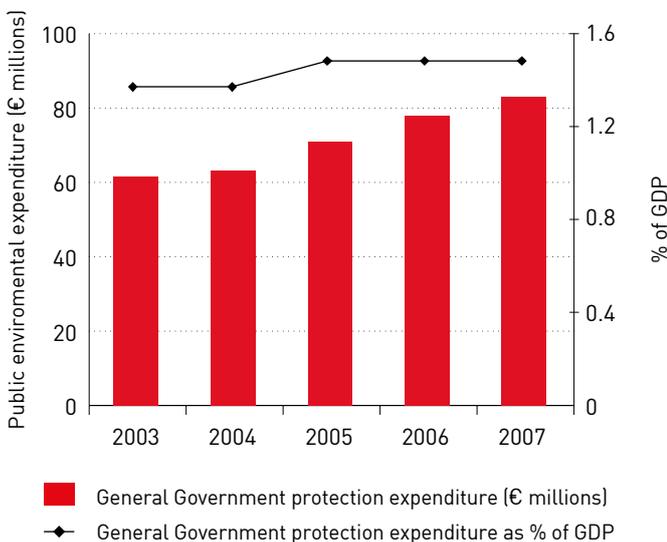
KEY MESSAGES:

- » Although Malta has made significant progress in upgrading its environmental policy capacity, its institutional capacity still needs to improve in terms of human resources and funding, as well as public and private sector investments to upgrade operations and infrastructure.
- » Government environmental expenditure amounted to €81.8 million in 2007, up by 31 percent from the 2004 level, and equivalent to 1.5 percent of GDP. Waste management, including wastewater treatment, absorbed almost 90 percent of this expenditure.
- » Green jobs contribute approximately two percent of GDP and between 2.5 and 3 percent of Malta's employment, and are principally in the waste management and water areas.
- » Environmental policy continues to rise in importance on the national agenda, and public opinion polls continue to indicate high levels of concern about environmental issues; yet this level of concern is not often translated into individual action.
- » Although there has been an increase in holistic and participative initiatives to promote environmental education, there remains the need for a national environmental education policy to guide the formal, non-formal and informal educational sectors, and including making environmental education mandatory in the national curriculum.
- » With some 50 economic instruments related to the environment, Malta is currently making notable use of environmental-economic instruments, but with varying degrees of success. A more coherent approach contextualised within the country's overall environmental management strategy and overall package of environmental-economic instruments is recommended.
- » Given that the current level of Green Public Procurement (GPP) is negligible, the formulation of a National Action Plan for GPP is welcomed. However, in order to promote sustainable consumption and production in Malta, this needs to be formally approved by Government and mainstreamed into the work of the various entities.
- » There is still significant potential for use of voluntary schemes such as EMAS and eco-labelling by business and public organizations. These schemes could be exploited better if organisations were incentivised to apply for the schemes, and if they were provided with active technical support.
- » The National Sustainable Development Strategy represents an important road-map for achieving sustainability in Malta. Ownership of the Strategy by all policy sectors is crucial and these now need to take up the priorities of the strategy, particularly in terms of new policy, legislation and practices in key sectors such as energy, transport, land use planning, and tourism. Administrative mechanisms are necessary to ensure this takes place.
- » Further development of participatory approaches and the strengthening of civil society in general would help significantly with the ongoing democratization of Maltese society with respect to decision-making that affects the environment.

While the primary focus of this report is the state of Malta's environmental media, it is useful to consider the typical actions taken by Government and other actors to address environmental and sustainability issues. This chapter reviews Malta's principal policy responses, beginning with the environmental policy instruments typically used by governments, and then discussing environmental governance issues. The chapter closes with a look at the integration of environmental policy objectives into other sectors.

In responding to environmental issues, governments have a range of instruments at their disposal, but typically use either economic instruments, legislative, awareness-raising and educative measures, or voluntary schemes.⁵¹⁵ Malta has taken on board a large majority of its environmental obligations from the EU *acquis communautaire*, and has rapidly increased its general government expenditure to address these obligations.⁵¹⁶ **Environmental expenditure amounted to €81.8 million in 2007, up by 31 percent from 2004** (Chart 11.1).⁵¹⁷ In 2007, this expenditure stood at 1.5 percent of GDP, and over 90 percent of it concerned solid and liquid waste management. An important dimension of this funding originates from international sources: during 2004-2006, almost €120 million (approximately 1.3 percent of GDP) were from EU sources, and in the 2007-2013 programme period, almost €1 billion will be available and may, in part, be used for environmental projects.⁵¹⁸ This expenditure comes with economic benefits: in 2001 the quantifiable benefits of complying with the environmental *acquis* were estimated⁵¹⁹ for Malta at 0.7 to 3.7 percent of GDP.⁵²⁰ Part of these benefits comes in the form of job creation: **the number of green jobs in the Maltese economy in 2007 was estimated at 4,100 (2.5 to three percent of jobs), principally in the waste sector.**⁵²¹ **These contribute approximately two percent of GDP** and are expected to continue growing by an amount in the region of six percent per annum, at least until 2010, compared to an overall growth in jobs of between two and three percent.

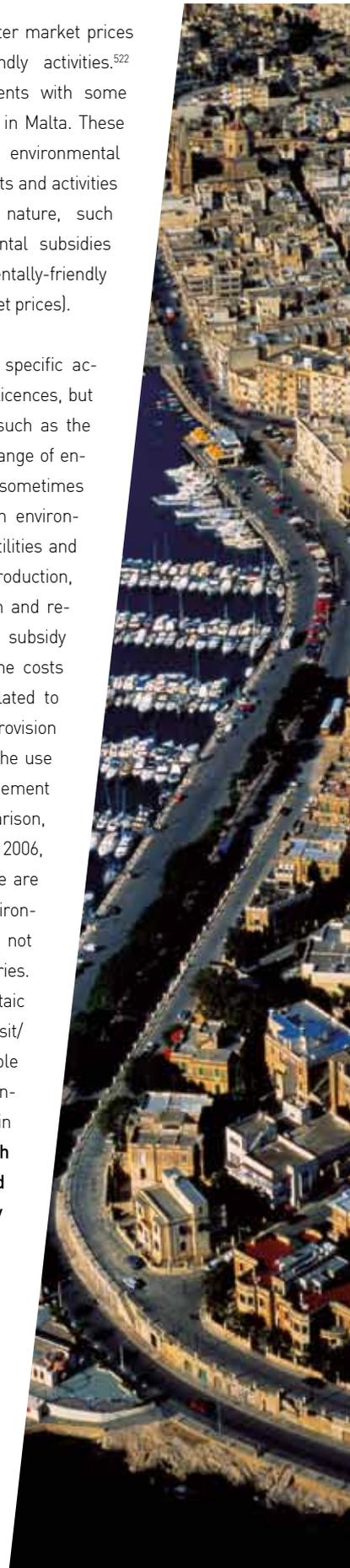
Chart 11.1: General Government Expenditure on Environment Protection



Source: NSO 2009g

Economic instruments seek to alter market prices to favour environmentally-friendly activities.⁵²² As of 2008, circa 50 instruments with some environment-related input were in use in Malta. These included taxes on specific activities, environmental charges (the final user prices of products and activities having an environmentally-sensitive nature, such as utilities and fuel) and environmental subsidies (measures to keep prices of environmentally-friendly products and activities lower than market prices).

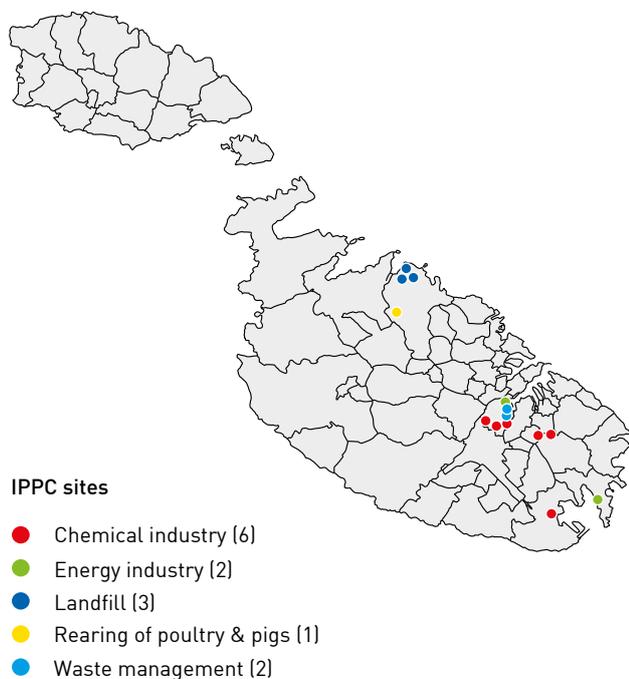
Environmental taxation may relate to specific activities, such as in the case of hunting licences, but could also involve wider instruments such as the eco-contribution, which is levied on a range of environmentally-sensitive products. It is sometimes argued that environmental charges on environmentally-sensitive products, such as utilities and fuel, do not reflect the full costs of production, implicitly subsidising over-consumption and resource depletion. However, no implicit subsidy would occur if the charges covered the costs of production (excluding any costs related to inefficiencies in the production and provision of the good or service in question).⁵²³ The use of subsidies for environmental management in Malta is relatively recent in comparison, and such subsidies cost €8.2 million in 2006, equivalent to 0.2 percent of GDP. There are also other economic instruments for environmental management in use, which do not fit neatly under any of the above categories. These include the purchase of photovoltaic energy produced by households, deposit/refund schemes for containers, tradable permits for fishing activity, and the involvement of the electricity producer in the EU emissions trading scheme. **With some 50 economic instruments related to the environment, Malta is currently making notable use of environmental-economic instruments. However, this has been with varying degrees of success.**⁵²⁴ **A more coherent approach contextualised within the country's overall environmental management strategy and overall package of environmental-economic instruments is recommended.**



Legal instruments have long been the mainstay of Malta's environmental policy, and the transposition of the EU *acquis* has led to the introduction of some 250 such instruments falling under the umbrella of the 2001 Environment Protection Act (Cap. 435). Between 2005 and 2008, 54 pieces of legislation were published in Malta transposing EU legislation. In the same period, 64 proposals for new pieces of environmental legislation were under discussion at EU level.⁵²⁵

One of the principal means of implementing environmental legislation is through permitting; and MEPA is setting up a comprehensive, risk-based, environmental permitting system based on three tiers. The highest tier of permitting will target the one percent of operations that involve the greatest environmental risks. In a second tier, general binding rules will cover some 12 percent of businesses.⁵²⁶ As of June 2008, 15 such rules for different operations had been developed. The remaining 88 percent of operations, such as those based in offices, will not need to be either permitted or subject to general binding rules. Operations in the highest risk category, such as those in the chemical and energy sectors, require an IPPC permit, underpinned by regular environmental audits.⁵²⁷ As of end 2008, 14 installations required such a permit (Map 11.1). At this point, six of the installations requiring a permit had been permitted, while the rest were at an advanced stage in the permitting process.

Map 11.1: Sites regulated under the IPPC Directive

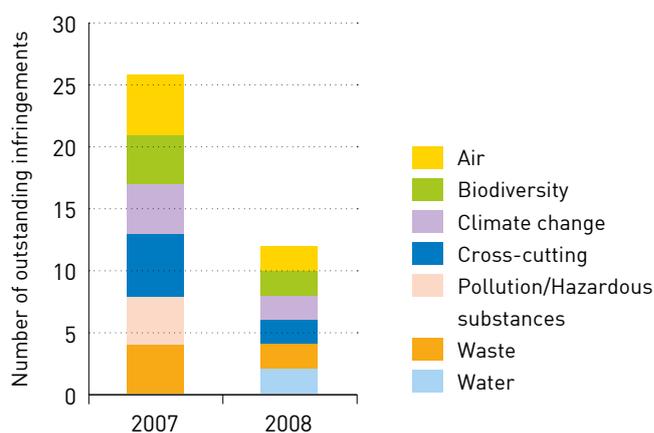


Source: MEPA

Enforcement is essential for the functioning of legislative instruments. At an EU level, this takes the form of infringement procedures against

Member States. As at end 2008, Malta had incurred a total of 12 environment-related infringements (31 percent of total infringements at that point) (Chart 11.2), and seven environment-related pre-infringement memos.

Chart 11.2: Outstanding environmental infringements by type and year of formal notice⁵²⁸



Source: MEPA

At a national level, the MEPA Reform is expected to strengthen MEPA's environmental enforcement role, together with the creation of a unified Enforcement Directorate. Coupled with the permitting regime described above, this process should help to instil the required culture of compliance noted in the previous state of the environment report. Enforcement carried out by other agencies also makes significant contributions to ensuring environmental quality. However, there is a need for better co-ordination, particularly in the areas of investigation, response to complaints by the public and market surveillance.

The third most commonly-used environmental policy instrument in Malta relates to public awareness-raising. The 2008 Eurobarometer environmental survey⁵²⁹ indicates that the main environmental concerns of the Maltese are related to air pollution, climate change and increasing waste generation. A national public attitude survey on the environment, which takes forward the then Planning Authority attitude surveys of 1989 and 1999, underlines the concern about air pollution and indicates high levels of concern about the environment.⁵³⁰ However, while such **public opinion polls continue to indicate high levels of concern about environmental issues, and environmental issues continue to gain prominence within national policy, this level of concern is not often reflected in individual action to reduce pollution by changing personal consumption patterns.**⁵³¹

Malta is making progress in environmental education, which aims not only to increase environmental awareness and knowledge across society, but also to empower people to be more environmentally-responsible. Since 2005, the Centre for Environmental Education

has strengthened its capacity to support and provide environmental education. During the same period, EkoSkola,⁵³² coordinated by Nature Trust (Malta), increased its coverage to 43 percent of schools (76 schools covering 30,000 students), more than double the coverage in 2004/2005.⁵³³ As of end 2008, several Maltese schools had also gained EkoSkola awards. While previously severely constrained by resources, since 2007 EkoSkola can draw on five full-time teachers seconded from the public service. One of the focuses of the EkoSkola year is the parliamentary session with schoolchildren, and the 2006 session focussed on a children's review of the 2005 State of the Environment Report. In another initiative *Dinja Wahda* (One World), run by BirdLife Malta, involved 74 primary schools, and in the 2007/2008 scholastic year, 33 schools reached the Gold Award level.⁵³⁴

However, **despite the increase in holistic and participative environmental education initiatives**, the sector remains undeveloped. The National Minimum Curriculum still does not include environmental education, environmental education initiatives for adults are still relatively rare, and the media has not seriously engaged with the issue. This suggests that **there is need for a national environmental education policy to guide the formal, non-formal and informal educational sectors, and including making environmental education mandatory in the national curriculum**. This policy should also address the development, evaluation and dissemination of educational materials that address Malta's specific environmental characteristics and vulnerabilities.

Voluntary environmental agreements are a more flexible environmental policy instrument, generally limiting costs and helping to achieve efficient implementation, and therefore generally more acceptable to industry.⁵³⁵ Overall, so far, there has been lack of penetration of such schemes in Malta. Four international voluntary environmental schemes are in operation. The International Organisation for Standardization (ISO) 14001 standard on environmental management⁵³⁶ had been taken up by five Maltese operators by June 2008, up one from 2005.⁵³⁷ The EU Eco-Management and Audit Scheme (EMAS),⁵³⁸ which builds upon and extends ISO 14001, is also a voluntary environmental management scheme. This has only been taken up by ST Microelectronics (Malta) Ltd, although the Malta Standards Authority⁵³⁹ is running two projects to improve EMAS penetration.⁵⁴⁰ Newly-introduced and of particular interest is the EU Blue Flag Programme, focussing on beach management.⁵⁴¹ In 2008, St. George's Bay, St. Julian's was awarded Blue Flag status.⁵⁴² With dual environmental and touristic benefit, it is recommended that additional beaches, including natural sandy and rocky ones, become certified. Finally, Hilton Malta holds an Eco-label in the tourism category.⁵⁴³

In terms of national voluntary schemes, the MTA's hotel Eco-Certification scheme, aimed at improving the environmental performance of hotels, continues, although at end 2008 only 13 hotels retained their certification, down from 21 in 2005.⁵⁴⁴ This drop was related to some hotel closures, drop-outs and more stringent criteria introduced in early 2008. In addition, Government launched a Green Leaders scheme in 2005 to encourage government ministries, departments and agencies to follow sound environmental practices. This has resulted in the installation of 24 photovoltaic systems, over 100 office waste separation banks, and a gradual switch to energy efficient lighting. This scheme should increase the potential for GPP, on which the Government has finalised a National Action Plan.⁵⁴⁵ **Given that the current level of GPP is negligible, this plan is welcomed. However, in order to promote more sustainable consumption, this plan needs to be formally approved by Government and mainstreamed into the work of the various entities.** Food quality labels such as those relating to organic farming⁵⁴⁶ also encourage environmental protection. As of December





2008, 14 Maltese producers had obtained certification,⁵⁴⁷ and land registered as under organic cultivation covered 21.8ha, 15.6ha of which have been fully converted (0.19 percent of agricultural land⁵⁴⁸).⁵⁴⁹ This brief review indicates that **there is still considerable potential for business and public organisation to use voluntary schemes such as EMAS and eco-labelling. These could be promoted better if organisations were incentivised to apply for these schemes**, for example through preferential access to public contracts, **and if they were provided with active technical support.**

As the environment gains importance in policy agendas, there has been growing recognition of the need to seek better and more effective involvement of actors from outside Government in policy-making processes.⁵⁵⁰ To address these issues, the Aarhus Convention⁵⁵¹ on environmental governance was agreed, and Malta has ratified this convention and transposed⁵⁵² the two related EU Directives.⁵⁵³ During 2008 Malta's administrative capacity to implement the Convention was strengthened through a twinning project with Austria.⁵⁵⁴ The following review is based on project findings.

In order to implement the access to information provisions of the Convention, a national framework, mainly based on the internet,⁵⁵⁵ has been developed, through which environmental information is made available to the public both on a regular basis and upon request. Despite significant progress in the amount of environmental information now found online, however, there is scope for additional streamlining of environmental data flows.

With regard to the second pillar of the Aarhus Convention, relating to public participation, while Malta is fully compliant with EU Directives in this regard, there exists the potential to refine Malta's praxis, making it deeper and broader, and ensuring that the various groups that make up the public are more able to influence decision-making. Emerging issues in this regard involve: lack of clarity regarding both the overall scope of the convention; a reliance on passive and document-based participation processes; sometimes overly-short consultation periods; lack of familiarity with planning processes and time and resource costs for various sectors of society and institutions. It is important that effective communication and training of key actors is undertaken, since well-organised participation processes can engender a culture of cooperation and trust, and positive public perceptions of procedural quality and participation opportunities. **Further development of participatory approaches and the strengthening of civil society in general would help significantly with the ongoing democratization of Maltese society with respect to decision-making that affects the environment.**

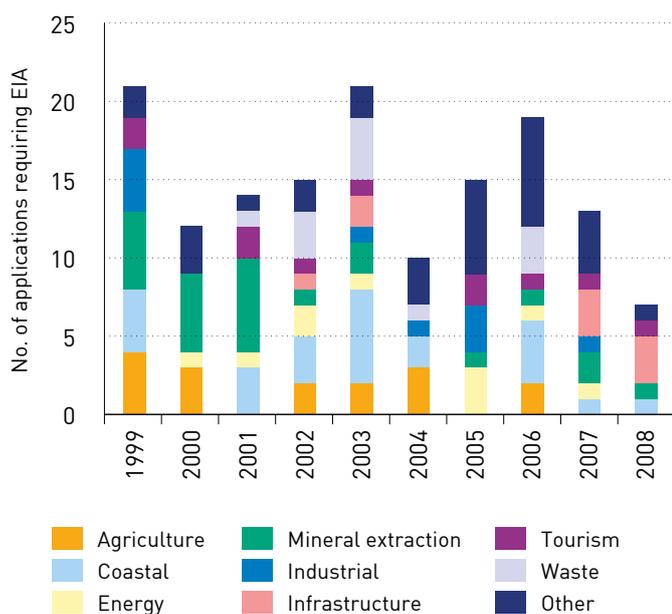
With respect to access to justice, the third pillar of the Aarhus Convention, an administrative review in cases of lack of compliance with the access to information provisions of the Convention can be sought through an internal challenge within the Authority, followed by a challenge through the MEPA Audit Officer. Parties that feel aggrieved by certain decisions may also take their case to the national Ombudsman, although this remedy does not have executive standing, as intended under the Convention. Although there is no system of administrative review on environmental issues (except for appeals against planning decisions), judicial review of administrative discretion is not financially prohibitive. An overriding and binding judicial review procedure is catered for in Section 469A of the Code of Civil Procedure. However, MEPA's reform proposals recommend that the remit of Planning Appeals Board is extended to environmental issues.⁵⁵⁶ The Voluntary Organisations Act (Cap. 492) was an important step forward towards granting recognition and standing to voluntary organisations, as stipulated in the Convention. Although environmental organisations do receive financial support from Government, there is scope for additional provision.

The concept of sustainable development has grown out of the conviction that environmental protection can only be achieved if environmental concerns are taken on board by other sectors, principally those concerning economic development. The National Commission for Sustainable Development is Malta's primary body responsible for promoting sustainable development, with the important responsibility to prepare a National Strategy

for Sustainable Development. This has been done,⁵⁵⁷ and the Strategy was approved by the Commission in December 2006 and Cabinet in 2007. **The National Sustainable Development Strategy represents an important road-map for achieving sustainability in Malta. However, ownership of the Strategy by all policy sectors is crucial, and these now need to take up the priorities of the strategy, particularly in terms of new policy, legislation and practices in key sectors such as energy, transport, land use planning, and tourism. Administrative mechanisms are necessary to ensure this takes place.** One of the Strategy's key recommendations concerns the setting up of an adequately-staffed office to coordinate its implementation, and to regularly publish sustainability indicators to monitor its effectiveness. In March 2008, sustainable development, along with environment, became part of the Prime Minister's⁵⁵⁸ portfolio.

One of the most effective measures to ensure the consideration of environmental impacts in decision-making across all sectors is to subject development projects and plans to environmental impact assessment (EIA) and strategic environmental assessment (SEA).⁵⁵⁹ Between 2004 and 2008, 64 planning applications required an EIA (Chart 11.3).⁵⁶⁰ As noted in the 2005 State of the Environment Report, the decline in the number of EIAs related to minerals extraction is due to the moratorium on applications for new quarry developments in place since 1998.⁵⁶¹ The drop in EIAs for agricultural development relates to a decision to consider pre-1992 farms as having a development permit, while fluctuations in those related to tourism were due to the fact that there were no new large hotels being built, while EIAs related to infrastructure are periodical due to the availability of financial packages.

Chart 11.3: Number of planning applications submitted between 1999 and 2008 that required an EIA



Source: MEPA

Concerted efforts have been made in the review period to increase transparency in the EIA process, through additional meetings with stakeholders and better access to online project information.⁵⁶² Two additional issues to be addressed concern the keeping of a register of EIA consultants⁵⁶³ and the assessment of alternatives (such as alternative sites, layouts or technologies) which has begun for some projects, but is not yet widespread. Other types of formal assessment, such as Appropriate Assessment may be required for certain projects if they affect protected areas (SACs and SPAs)⁵⁶⁴ or species of international importance. MEPA's environment officers also provide technical feedback on other smaller but nevertheless environmentally-significant projects.

The SEA Regulations⁵⁶⁵ provide a high level of protection for the environment by ensuring that the environmental dimension is integrated in the preparation and adoption of plans and programmes by Government, and that these are also subject to the widest possible level of public consultation. SEAs seek to address the source of environmental deterioration, assisting decision-makers to identify best environmental options early in the decision-making process (at plan-making stage), before specific development proposals have been prepared. The relevant competent authority is the SEA Audit Team, which has been proactive in its approach to raise awareness on the obligations emanating from these regulations. Between 2005 and August 2009, 27 plans or programmes were screened, five scoping reports submitted for review, and two environmental reports submitted, both concerning EU funding programmes.

Malta's major environmental policy responses indicate that the country continues to take firm steps forward with respect to environmental protection. However, the sector remains dominated by a legalistic approach, that is nevertheless mitigated by increasing efforts towards participation and transparency through measures such as environmental assessment, the sustainable development strategy preparation process and better access to environmental information. Greater efforts to make the best use of economic instruments, environmental education and voluntary schemes would allow a more flexible approach to achieving policy goals. In this respect, it would be beneficial, particularly for industry, which needs to adapt to the new policy framework introduced through EU accession, for Malta to develop a written environmental strategy or policy, which covers all the key environmental policy areas across Government. **Although the nation has made significant progress in upgrading its environmental policy capacity, it continues to require improved institutional capacity in terms of human resources, funding, as well as public and private sector investments to upgrade operations and infrastructure.**

ENDNOTES

1. NSO 2009a.
2. <http://epp.eurostat.ec.europa.eu>, accessed on 28th May 2009.
3. NSO 2008a.
4. Valletta lost 13 percent of its population and the entire historic Southern Harbour District lost 2.6 percent in this period.
5. Ernst & Young Ltd. and Cordina 2008.
6. NSO 2009b.
7. See section on minerals industry below.
8. Indeed, regulations [LN 295 of 2007 under the Environment Protection Act [Cap. 435] and the Development Planning Act [Cap. 356] [Environmental Management Construction Site Regulations, 2007]] on construction site management were issued in 2007, and have so far been applied in selected areas. Government is also preparing a Building (Regulation) Act (<http://mrra.gov.mt/htdocs/docs/Building%20Regulation%20Act%20DRAFT%203aug09.pdf>, accessed on 10th August 2009). See also review of these regulations in Chapter 4 on Land.
9. PA 2001. This estimate has lately been further substantiated by the fact that between the 1995 and the 2005 Census, the number of households grew by 17 percent or 20,000 households. See NSO 2007a.
10. Housing permissions exceed total application in 2004-2007 due to the increasing trend for development applications to involve multiple dwelling units.
11. NSO 2007b.
12. Central Bank of Malta 2009.
13. NSO 2009c.
14. NSO 2009d.
15. NSO.
16. This section draws on Ellul 2008.
17. See review of this scheme in Chapter 11 on Policy Responses.
18. Such as Malta: Int u T-Turist, which provides those working in the tourism sector with a wider perspective on tourism.
19. These figures are net of bunkering but include Jet A-1 and aviation gasoline.
20. Gas oil and fuel oil.
21. NSO.
22. NSO.
23. For more information on policy responses relating to environmental issues in the energy sector see the Climate Change Chapter.
24. GoM 2006a.
25. MRRA 2008.
26. MRRA 2009.
27. This review concerns land transport, although aviation and maritime transport also involve significant environmental impacts. Maritime transport is reviewed under the Coastal and Marine Environment Chapter.
28. NSO 2009e.
29. The dip in number of vehicles in 2005 may be explained by the fact that the stock of motor vehicles was re-assessed in the fourth quarter of 2005, in view of an improvement in the computation of cars that had been scrapped in past years.
30. AdT Licensing and Testing Department.
31. NSO 2008b, 2009e.
32. AdT.
33. For more information see <http://www.maltatransport.com/en/alt/Park.pdf>, accessed on 7th February 2008.
34. MITC 2008.
35. For more information refer to Chapter 2 on Air.
36. Lower and Upper Coralline Limestone.
37. Globigerina Limestone.
38. For more information see Chapter 4 on Land.
39. This section draws significantly on MEPA 2007a and MEPA 2007b.
40. These are further discussed in Chapter 11 on Policy Responses.
41. NSO 2005, 2007d, 2008c.
42. Considered as any piece of land that has been artificially irrigated.
43. MRAE 2007.
44. See Chapter 5 on Fresh Waters for more information.
45. MRAE 2007.
46. For more information see Chapter 4 on Land.
47. Benzene might be of a health risk in traffic sites however in 2007 the annual limit value was exceeded only in St Anne's Street, Floriana.
48. EEA 2005.
49. Council Directive 96/62/EC on Ambient Air Quality Assessment and Management (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0062:EN:HTML>, accessed on 6th November 2009), now revised by Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, transposed by LN 216 of 2001 under the Environment Protection Act [Cap. 435] [Ambient Air Quality Assessment and Management Regulations, 2001], and amended by LN 235 of 2004.
50. Directive 2001/81/EC of the European Parliament and the Council on National Emission Ceilings for certain pollutants [NEC Directive] (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:309:0022:0030:EN:PDF>, accessed on 6th November 2009), transposed by LN 291 of 2002 under the Environment Protection Act [Cap. 435] [National Emission Ceilings for Certain Atmospheric Pollutants Regulations, 2002], and amended by LN 232 of 2004.
51. The analysis is based on MEPA's air quality monitoring programme, as well as emission inventories related to the NEC Directive. MEPA's ambient air quality monitoring programme is based on two principal data sets, the first emerging from diffuser sample measurements taken across the Islands, and the second emerging from five automated real-time air quality monitoring stations located across the two islands. While diffusion tube network data is presented at three scales (national, locality/local council, and particular sites), data from the fixed air monitoring stations is provided as at the station itself (e.g. Msida, Żejtun, etc).
52. Nolle et al. 2005.
53. Directive 2005/33/EC of the European Parliament and the Council of 6 July 2005 as regards the sulphur content in marine fuels (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:191:0059:0069:EN:PDF>, accessed on 11th November 2009), amending Directive 1999/32/EC.
54. Versteng et al. 2007; CEC 2005a; EEA 2007a.
55. http://www.ec.gc.ca/cleanair-airpur/SOx-WSBB2123F-1_En.htm, accessed on 17th October 2007.
56. The WHO has removed its annual limit value for human health protection, however it is retained here and used in the following analysis for comparison purposes with previous years.
57. NSO.
58. NSO.
59. WHO 2006a.
60. EEA 2007a.
61. ATSDR 2004.
62. ATSDR 2004.
63. http://www.apis.ac.uk/overview/pollutants/overview_sources.htm, accessed on 15th October 2007.
64. EEA 2007a.
65. Annesi-Maesano et al. 2007.
66. PM₁₀ refers to particles with an aerodynamic diameter smaller than 10µm while PM_{2.5} refers to particles of diameter smaller than 2.5µm, with the latter being the more dangerous for human health due to their deeper lung penetration.
67. Permanently alter the genetic coding of a cell.
68. See section on ozone below.
69. EC 2006.
70. <http://www.epa.gov/iaq/voc.html>, accessed on 26th September 2007.
71. Unleaded petrol has a very low benzene concentration (less than 1 percent) when compared to leaded petrol, which has a concentration of between 6 and 8 percent.
72. HSE 2007.
73. EEA 2005.
74. Klumpp et al. 2006.
75. Nolle et al. 2005.
76. ODSs are used for a number of purposes including as foam blowing agents, solvents, fire extinguishers and refrigerants. In order of significance, ODSs are: chlorofluorocarbons (CFCs); halons; carbon tetrachloride; trichloroethane; hydrochlorofluorocarbons (HCFCs); methyl bromide and bromochloromethane (FOEN and FSO 2007).
77. Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:244:0001:0024:EN:PDF>, accessed on 11th November 2009).
78. LN 145 of 2007 under the Environment Protection Act [Cap. 435] [Substances Depleting the Ozone Layer Regulations, 2007].
79. See Chapter 3 on Climate Change.
80. See Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF>, accessed on 6th November 2009), transposed by LN 292 of 2007 under the Environment Protection Act [Cap. 435] [Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2007].
81. MEPA - PPCU 2007.
82. The Fourth Daughter Directive (2004/107/EC) under the AQWF obliges Member States to determine the ambient air concentrations of the above pollutants and to define zones and agglomerations in which the concentrations are above or below the respective limit values set by the directive. Limit values include annual and upper and lower assessment thresholds. If the latter are exceeded for a particular pollutant, the Member State is obliged to monitor that pollutant on a continuous basis.
83. For arsenic, the Fourth Daughter Directive (2004/107/EC) defines an annual limit value of 6ng/m³ and an upper and lower assessment threshold of 3.6 ng/m³ and 2.4 ng/m³ respectively.
84. For cadmium the Fourth Daughter Directive (2004/107/EC) sets an upper assessment threshold of 3ng/m³ and a lower one of 2ng/m³.
85. MEPA - PPCU 2007.
86. EC 2002.
87. MEPA - PPCU 2007.
88. The diffusion tube network monitors nitrogen dioxide, sulphur dioxide, ozone, benzene, toluene, mp-xylene, ethyl benzene, and o-xylene.

89. <http://www.mepa.org.mt/airquality>, accessed on 11th November 2009.
90. <http://www.eea.europa.eu/maps/ozone/map>, accessed on 3rd November 2009.
91. MEPA 2006a.
92. For more detail see Chapter 3 on Climate Change.
93. For further information see MEPA 2006a.
94. Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants (<http://eur-lex.europa.eu/LexUriServ/site/en/consleg/2001/L/02001L0080-20011127-en.pdf>, accessed on 6th November 2009), transposed by LN 329 of 2002 under the Environment Protection Act (Cap. 435) (Limitations of Emissions of Certain Pollutants into the Air from Large Combustion Plants, 2002), amended by LN 2 of 2008.
95. MEPA 2009a.
96. For more information see Chapter 10 on Relationships between the Natural Environment and Economic Activity.
97. For more information see Chapter 11 on Policy Responses.
98. EEA 2007a.
99. <http://unfccc.int>, accessed on 9th November 2009.
100. In December 2008, however, Malta expressed its intention to change its status under the UNFCCC to Annex 1.
101. CEC 2005b.
102. CEC 2000.
103. Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0032:EN:PDF>, accessed on 6th November 2009), transposed by LN 140 of 2005 under the Environment Protection Act (Cap. 435) [European Community Greenhouse Gas Emissions Trading Scheme Regulations, 2005].
104. CEC 2007a.
105. CEC 2009.
106. CEC 2007b.
107. CEC 2007c.
108. CEC 2007d.
109. CEC 2008a.
110. CEC 2008b.
111. CEC 2008c.
112. CEC 2008d.
113. CEC 2008e.
114. MRAE 2004a.
115. MRAE 2004a.
116. EEA 2005.
117. CEC 2007a.
118. NSO.
119. See Chapter 5 on Fresh Waters.
120. EEA 2007a.
121. MRA.
122. IPCC 2001.
123. IPCC 2007.
124. MMA.
125. IPCC 2007.
126. MRAE 2004a.
127. The IPCC fourth assessment report (2007) states that small islands, whether located in the tropics or higher latitudes, have characteristics which make them especially vulnerable to the effects of climate change, sea-level rise, and extreme events.
128. MEPA 2009a.
129. Including the energy industry, and transport and fuel combustion in the industrial, commercial, institutional and residential sectors.
130. As calculated in terms of CO₂ equivalents for CO₂, CH₄, N₂O, HFC_s and SF₆ 'without' LUFLUF.
131. As calculated in terms of CO₂ equivalents 'without' LUFLUF.
132. As calculated in terms of CO₂ equivalents 'without' LUFLUF.
133. MEPA 2009b.
134. For example between 2000 and 2005, when the trend was increasing.
135. EEA 2008a.
136. MEPA 2009a.
137. EEA 2005.
138. In Malta almost all energy is generated from imported fossil fuels. Amounts used are net of bunkering but include Jet-A1 and aviation gasoline.
139. Relative decoupling occurs when environmental damage increases at a slower rate than GDP, while absolute decoupling occurs when environmental damage decreases while GDP increases.
140. 2003/87/EC.
141. This cap, notified under a National Allocation Plan and covering a specified period of years, is distributed as allowances (emissions rights or permits) to the participating installations. This flexible approach, through the possibility of trading the allowances, allows for emissions to be reduced where it is less costly to do so, with installations that experience a growth in emissions over and above their allocation being allowed to acquire allowances from installations with excess allowances due to emission levels being lower than their initial allocation.
142. MRAE 2006.
143. This mechanism allows both Kyoto Protocol Annex I countries with a greenhouse gas reduction commitment, and non-Annex I countries to invest in projects that reduce emissions either in their own countries (if they are non-Annex I countries such as Malta) or in developing countries (in the case of Annex I countries). The reduced emissions may be claimed as credits that the country can use in order to reach its compliance target or sell to other countries.
144. GoM 2006a.
145. MRES 2006.
146. GoM 2008.
147. MRRA 2009.
148. Climate Change Committee 2009.
149. CEC 2008a.
150. Indeed, the impact assessment on the EU Climate-Energy Package envisages a 10 percent RES target for Malta (CEC 2008f).
151. GoM 2006a.
152. MEPA 2009a.
153. These focus on more efficient energy generation at the power stations, including the installation of more efficient generating capacity, as well as a submarine cable interconnection to the European network.
154. The latter include rebates on energy-efficient domestic appliances, promotion of solar water heaters, grants on purchase of micro RES generation equipment, and distribution of energy-saving lamps in the domestic sector.
155. This concerns a €10 million Malta Enterprise ERDF grant scheme to assist industry with projects, among them ones related to energy efficiency and use of RES.
156. Efficiency-related technical measures include improved energy efficiency in street lighting, energy saving in water production and distribution, and the installation of a steam recovery turbine at the Marsa Thermal Treatment Facility.
157. In order to raise awareness about RES with citizens using civic amenity sites, micro RES systems have been installed at these sites, and a RES centre will demonstrate various options at the closed Maghtab landfill.
158. The SWITCH campaign was launched in 2009.
159. LN 238 of 2006 under the Malta Resources Authority Act (Cap. 423) (Minimum Requirements on the Energy Performance of Building Regulations, 2006). Revised regulations that take on board further provisions of the Directive were approved in October 2008 (LN 261 of 2008).
160. These include reform of the public transport system, an intelligent traffic management system, and promoting fuel-efficient vehicles through a revised vehicle registration system.
161. Waste-related measures include the combustion of methane generated by the Maghtab and Qortin landfill, gas management at the new non-hazardous managed landfills at Ta' Zwejra and Ghallis, The digestion process at the Sant' Antnin Waste Treatment Plant, which will recover of biogas, the methane portion of which will be used for the generation of clean electricity, and anaerobic sludge digestion facilities with biogas production at the Malta South Sewage Treatment Plant.
162. MEPA 2007c.
163. Under the National Strategic Plan for Research and Innovation (GoM 2006b).
164. http://www.hm-treasury.gov.uk/stern_review_report.htm, accessed on 11th November 2009.
165. This calls for action through measures such as vulnerability assessments, response strategies, integration of adaptation actions into national and sectoral planning, disaster reduction strategies, and economic diversification to build resilience. (http://unfccc.int/meetings/cop_13/items/4049.php, accessed on 3rd June 2009).
166. CEC 2009.
167. http://www.mra.org.mt/water-twinning_project.shtml, accessed on 3rd November 2009.
168. http://www.mra.org.mt/library_links.shtml#, accessed on 29th May 2009.
169. The European Environment Agency's CORINE (COordinate INformation on the Environment) system provides regular harmonised information about land cover and land cover change across Europe. See EEA 2008b.
170. In the Maltese context, while CLC information assists with understanding land cover in Malta, and monitoring large scale change over longer timeframes, the large scale (25 ha) of the grid used does not permit analysis sensitive enough to monitor short-term land use change.
171. These include sparsely vegetated areas and sclerophyllous vegetation (vegetation having hard leaves).
172. As defined in the Building Permits (Temporary Provisions) Act (Cap. 322).
173. See also discussion on housing in Chapter 1.
174. NSO 2007a.
175. PA 2002a.
176. See also discussion on agriculture in Chapter 1 on Driving Forces for Environmental Change.
177. For more information refer to Chapter 1 on Driving Forces for Environmental Change and Chapter 9 on Environmental Health.
178. Including tool rooms and reservoirs, as well as livestock and fish farms.

179. MEPA Dwellings Database, based on an analysis of development permitted Outside Development Zones between 2000 and 2007.
180. Such as schools and the Mater Dei Hospital.
181. As detailed in the 2004-2006 Rural Development Plan (MRAE 2004b) and the 2007-2013 Rural Development Strategy (MRAE 2007).
182. See Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (<http://ec.europa.eu/environment/water/water-nitrates/directiv.html>, accessed on 6th November 2009), transposed by LN 343 of 2001 under the Environment Protection Act (Cap. 435) [Protection of Water Against Pollution Caused by Nitrates from Agricultural Sources Regulations, 2001], amended by LN 233 of 2004. The Code is a compilation of good farming practices pertinent to all the other Directives, prevailing national legislation, and good farming practices and consists of a list of codes of good practices on animal husbandry, manure handling, application of fertilisers, irrigation practices and plant protection.
183. Between 2004 and 2006, three measures were in place: supporting the restoration of rubble walls (1,642 farmers benefited, covering 28ha), conservation of autochthonous species (six beneficiaries supported, focusing on conservation of the Holm Oak, covering 2.7ha), and organic farming (covering 15ha) (MRAE).
184. MRAE 2007.
185. <http://www.mepa.org.mt/LpDocumentDetails?syskey=%20756>, accessed on 3rd November 2009.
186. Organic farming seeks to reduce or eliminate the use of synthetic pesticides, herbicides, chemical fertilisers, growth hormones, and antibiotics, as well as gene manipulations. Council Regulation 2092/91 (of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs [<http://eur-lex.europa.eu/LexUriServ/site/en/consleg/1991/R/01991R2092-20070101-en.pdf>, accessed on 11th November 2009]) and later amendments, provide a legal framework for organic farming in the EU.
187. Of these 15.5ha have been fully converted, while 6.2ha were in the conversion period.
188. MSA.
189. Petruzzella and Verrastro 2002.
190. See review of agri-environmental measures above.
191. Cassar *et al.* 2004.
192. Ministry for the Environment 2001.
193. Under the legislative framework provided by LN 337 of 2001 under the Environment Protection Act (Cap. 435) [Waste Management (Permit and Control) Regulations, 2001] and LN 168 of 2002 under the Environment Protection Act (Cap. 435) [Waste Management (Landfill) Regulations, 2002].
194. RSPB undated.
195. Development Planning Act (Cap. 356) and Structure Plan Policy RCO 1.
196. Area scheduled for high landscape value covers 15.6 percent of the Maltese Islands.
197. See Chapter 8 on Biodiversity.
198. <http://esa.un.org/unup>, accessed on 2nd May 2008.
199. MEPA 2003.
200. MEPA 2002a. More information may be found in Chapter 1 on Driving Forces for Environmental Change.
201. Falzon 2007.
202. For more information see section on housing in Chapter 1 on Driving Forces for Environmental Change.
203. In the Maltese context, a tall building is one that are more than twice as high as the maximum building height limitation of the locality established by the Local Plan, or more than 10 floors (40 metres), whichever is the lower when measured from the lowest street level. A medium-height building is one that is equal to or less than twice the statutory building height or 10 floors (40 metres). MEPA 2006b.
204. At Tigné, St. Julian's, Gzira, Paola, St. Paul's Bay, Sliema and Luqa.
205. Kamra tal-Periti 2007; TPPI 2008.
206. Those related to the transport and energy sectors, air pollution and waste are discussed in the respective chapters.
207. <https://secure2.gov.mt/mitc/page.aspx?pageid=137&index=4>, accessed on 3rd October 2008.
208. LN 295 of 2007 under the Development Planning Act (Cap. 356) and the Environment Protection Act (Cap. 435) [Environmental Management Construction Site Regulations, 2007].
209. MEPA 2006b.
210. The FAR provides developers of sites of a considerable area (3,000 square metres) with an opportunity to increase development height, whilst providing larger public landscaped open space at ground floor by using the same developable floor space normally available by developing the whole site.
211. The UIF is accumulated through planning gain contributions levied from particular developments where parking spaces cannot be provided on site, and where the Commuted Parking Payment Scheme is not yet in force.
212. <http://mri.gov.mt>, accessed on 2nd October 2008.
213. See the Malta Structure Plan (MDI 1990a: para 15.4). For more information see: <http://www.culturalheritage.gov.mt/page.aspx?p=3090&l=1>, accessed on 3rd October 2008.
214. <http://whc.unesco.org>, accessed on 3rd October 2008.
215. Kamra tal-Periti 2007.
216. See Structure Plan Policy UCO 1.
217. In some cases, UCAs spread across various localities such as Attard, Balzan, Birkirkara and Lija, and are contiguous and therefore considered as one UCA. In other localities such as Żurriq, two physically separate UCAs are considered one UCA.
218. This categorisation allows controlled changes in the lesser category and stringent conservation in the higher category. See MEPA 2009c.
219. The NPI lists, based on criteria established by the Structure Plan, historical buildings, gardens and other open spaces, and streetscapes that require protection.
220. Antiquities (Protection) Act (Cap 54).
221. Under Structure Plan Policy UCO 7 (MDI 1990b). In some cases scheduled sites are de-scheduled, partly de-scheduled or re-graded. See Camilleri *et al.* forthcoming.
222. Two sites were within the Scheduled Buffer Zone for Lija Belvedere, and the third is Santa Cilja Medieval Chapel in Ghajnsielem.
223. See <http://www.mepa.org.mt/schedschedulingsearch>, accessed on 11th November 2009.
224. Article 46 (9) of the Development Planning Act (Cap. 356).
225. As a result, three properties in St. Julian's, in Kalkara and in Sannat respectively were partly de-scheduled (with another five pending approval), seven were completely de-scheduled, five in St. Julian's, one in Sliema and one in Valletta (with one pending) and two, in Attard and Rabat, were given a lower level of protection (one case pending).
226. Camilleri *et al.* forthcoming.
227. Camilleri *et al.* forthcoming.
228. Kamra tal-Periti 2007.
229. Camilleri *et al.* forthcoming.
230. For example, at Rabat and Mdina two illegal developments in 2005 uncovered Roman ashlar masonry and substantial archaeological deposits. Enforcement action was subsequently taken.
231. https://secure2.gov.mt/mitc/MediaCenter/PDFs/1_16392-%20Grand%20Harbour%20Insert%20ENG%20Small.pdf, accessed on 3rd October 2008.
232. Camilleri *et al.* forthcoming.
233. Indeed conservation of geological and geomorphological sites in Malta is a statutory responsibility of MEPA Under Article 46 (1) of the 1992 Development Planning Act (Cap. 356).
234. LN 311 of 2006 under the Environment Protection Act (Cap. 435) and the Development Planning Act (Cap. 356) (Flora, Fauna and Natural Habitats Protection Regulations, 2006), as amended by LN 162 of 2009.
235. CEC 2006a.
236. Sammut 2005.
237. This monitoring was carried out by the then National Soils Unit of the then Ministry for Rural Affairs and the Environment.
238. National Soils Unit (MRAE).
239. National Soils Unit (MRAE).
240. See review of IPPC (Integrated Pollution Prevention and Control) in Chapter 11 on Policy Responses.
241. Eionet Central Data Repository 2008.
242. Contaminated land is '[a]ny site or region that is damaged harmed or made unfit for use by the introduction of unwanted substances, particularly micro organisms, chemicals, toxic and radioactive materials and wastes.' (http://glossary.eea.europa.eu/terminology/concept_html?term=contaminated%20land, accessed on 13th March 2008).
243. National Soils Unit (MRAE).
244. EEA 2005.
245. MRA 2007a.
246. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:HTML>, accessed on 6th November 2009), transposed by LN 194 of 2004 under the Environment Protection Act (Cap. 435) [Water Policy Framework Regulations, 2004].
247. This chapter addresses groundwater and inland surface waters, while transitional, coastal and marine waters are discussed in Chapter 6 on the coastal and marine environment.
248. MRA.
249. FAO 2006.
250. The available volume for extraction at 23 million m³ is derived from FAO (2006). This report cites an initial value of 25 million m³; but it also recommends a 10 percent cut-back in this volume in order to allow the resource to re-establish itself, effectively reducing this figure to 23 million m³.
251. MRA.
252. High nitrate levels in the body are of concern since they reduce the oxygen carrying capacity of blood, with infants being the most vulnerable [see WHO 2004].
253. MRA.
254. See section 6.2.3 (Box 6.3) in Chapter 6 on the Coastal and Marine Environment, on discharges to sewers from industry.
255. MRAE 2004b.
256. 91/676/EEC.
257. CEC 2007e.

258. Other factors are involved, such as level of active ingredients, and whether it is a slow or fast release product, but also since it is the application not the importation of fertilisers that is the matter of concern.
259. NSO.
260. NSO 2008h.
261. Other sea-water related parameters such as sulphate, sodium etc are also of concern, albeit not at the high levels of chloride.
262. This standard is however an organoleptic parameter relating to taste and is not meant as a qualitative standard reflecting groundwater quality. Malta is currently in the process of developing a threshold value for chlorides in groundwater as per the obligations of the Groundwater Directive.
263. WHO 2006b.
264. 91/676/EEC.
265. Note that since the Xewkija WSC abstraction borehole has not been consistently utilised the values may not be as reliable as those of other boreholes.
266. Currently the Nitrates Action Plan is being revised by a dedicated Nitrates Action Group composed of members from the OPM, MRRA, MEPA and the MRA.
267. MRA 2005a.
268. Several data gaps constrain the accuracy of the water balance estimations.
269. MRA 2005b.
270. See below and Chapter 2 on Climate Change.
271. Wied tal-Lunzjata, Wied tal-Bahrija, Wied il-Luq, L-Ghadira, is-Simar, il-Qattara, L-Ghadira ta' Sarraflu, is-Salini, l-Ghadira s-Safra, il-Magħluq ta' Marsascala and il-Ballut ta' Marsaxlokk. The full list of surface waters can be found in the Article 5 report (MEPA 2005a).
272. Debono and Scerri 2007.
273. MRA 2007a.
274. 91/677/EEC.
275. 2000/60/EC.
276. MRA 2007a.
277. This index identifies periods of hydrological imbalance.
278. MRA 2007b.
279. MRA 2007a.
280. EEA 2007a.
281. MRA 2007a.
282. Council Directive 91/271/EEC of 21 May 1991 concerning Urban Waste-Water Treatment (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0271:EN:HTML>, accessed on 6th November 2009), transposed by LN 340 of 2001 under the Environment Protection Act (Cap. 435) (Urban Waste Water Treatment Regulations, 2001), amended by LN 192 of 2004 and LN 120 of 2005.
283. MRA 2007c.
284. This review draws on the EU-funded DEDUCE project (<http://www.deduce.eu>, accessed on 3rd August 2009).
285. 2000/60/EC.
286. Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe (2002/413/EC). (<http://www.coastlaw.uct.ac.za/iczm/legis/ec/20020413.pdf>, accessed on 5th November 2009).
287. 91/271/EEC.
288. Council Directive 2006/77/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0037:0051:EN:PDF>, accessed on 6th November 2009) and repealing Directive 76/160/EEC, transposed by LN 125 of 2008 under the Public Health Act (Cap. 465) (Management of Bathing Water Quality Regulations, 2008).
289. http://195.97.36.231/dbases/webdocs/BCP/BC76_Eng.pdf, accessed on 3rd October 2008.
290. Council Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF>, accessed on 6th November 2009).
291. CEC 2007f.
292. CEC 2006b.
293. <http://www.unepmap.org/Index.php?module=content2&catid=001001001>, accessed on 14th August 2008.
294. This review draws on the findings of the EU-funded DEDUCE project.
295. NSO 2007b.
296. MMA 2006, 2007, 2008.
297. MMA and MITC 2009.
298. These are proposed for Mġarr (Gozo), Ċirkewwa, Marfa, Qawra (East side), Ta' Xbiex (next to Royal Malta Yacht Club), Ta' Xbiex (between Gżira Gardens and water polo club), Sa Maison, Kalkara, Marsascala (Zonqor Point) and Birzebbuga (San Ġorġ).
299. These include: the Lands Department; MEPA, responsible for permitting not only development but also, through its environmental permitting system, beach activities such as parties; the MTA, which licences operators to rent out deckchairs and umbrellas, and is involved in beach cleaning, management and safety activities; the Department for Environmental Health, which monitors bathing water quality; local councils; and, the Malta Police.
300. See below.
301. 2006/7/EC.
302. EEA 2005.
303. PA 2002b.
304. MMA 2007, 2008.
305. MMA 2007.
306. See Chapter 5 on Fresh Waters for review of discharge of sewage waters at sea.
307. The WFD defines transitional waters as surface waters close to river or stream mouths that are partly saline since they are close to coastal waters, but which are influenced by freshwater flows.
308. Schembri 1994.
309. Tejada et al. 2007.
310. MEPA 2006c.
311. These include: Il-Hofra ż-Żgħira; Ras il-Qarraba; ix-Xatt l-Ahmar; and, Kemmuna.
312. Geotek Services 2007.
313. 2006/7/EC.
314. http://195.97.36.231/dbases/webdocs/BCP/BC76_Eng.pdf, accessed on 3rd October 2008.
315. MEPA 2002b.
316. MEPA 2005b.
317. 2002/413/EC.
318. 2008/56/EC.
319. <http://www.deduce.eu/results.html>, accessed on 3rd August 2009.
320. Please see review of waste-water treatment plants in Chapter 5 on Fresh Waters.
321. 91/271/EEC.
322. The removal of dead Posidonia leaves in late spring from sandy beaches, which has ecological implications, is a case in point.
323. DOI 2007.
324. See review of Blue Flag certification in Chapter 11 on Policy Responses.
325. These include the EU Habitats Directive, the Protocol on Integrated Coastal Zone Management in the Mediterranean, which Malta signed in January 2008, together with the SPA and Biodiversity Protocol, both under the Barcelona Convention, and the UN Convention on Biological Diversity, as well as the Bonn and Bern Conventions. For more details see Chapter 8 on Biodiversity.
326. CEC 2005c.
327. DMC is calculated as the sum of total national mineral extraction and imports (direct material input), minus exports. Within the analysis of material flows, a number of other useful indicators such as domestic extraction, direct material input and material productivity also provide insights into resource use in Malta.
328. EC2001.
329. This section draws on Gazley and Moncada 2008.
330. Domestic extraction comprises the mass of material extraction associated with biomass, which includes items such as fish and crops, and mineral extraction.
331. This is the input of materials directly used by the economy, that is, all materials that form part of products or are used in production and consumption activities.
332. Exports of fossil fuels from Malta mainly consist of bunkers, however these does not exclude exports of waste oils, or other oil products which are brought to Malta to be exported again to other countries.
333. All absolute numbers except for GDP are in tonnes.
334. Calculated by dividing GDP in real terms by DMC.
335. Eurostat indicates comparability limitations for DMC calculations between the different EU Member States, due to use of different methodologies.
336. Latest Eurostat data for DMC, as at publication of Gazley 2008, was for 2004.
337. See reviews of land, water, limestone and energy consumption in the respective chapters of this Report on Land, Fresh Waters, and Driving Forces for Environmental Change.
338. For details please see Chapter 1 on Driving Forces for Environmental Change.
339. See <http://ec.europa.eu/environment/waste/index.htm> (accessed on 6th November 2008) for more information.
340. EEA 2007b.
341. CEC 2005d.
342. Council Directive 75/442/EEC of 15 July 1975 on Waste, repealed by 2006/12/EC (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0009:0021:en:PDF>, accessed on 6th November 2009) and replaced by 2008/98/EC, transposed by LN 337 of 2001 under the Environment Protection Act (Cap. 435) (Waste Management [Permit and Control] Regulations, 2001).
343. Of the total amount by weight of biodegradable municipal waste produced in 1995.
344. Under Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:182:0001:0019:EN:PDF>, accessed on 9th November 2009), transposed by Ln 168 of 2002 under the Environment Protection Act (Cap. 435) (Waste Management [Landfill] Regulations, 2002), and amended by LN 289 of 2002, LN 70 of 2007 and LN 146 of 2007.
345. Under the European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:HTML>, accessed on 6th November 2009), amended by Directive 2004/12/EC and 2005/20/EC, transposed by LN 98 of 2004 under the the Environment Protection Act (Cap. 435) and Product Safety Act (Cap. 427) (Packaging and Packaging Waste Regulations, 2004), repealed by LN 277 of 2006.

346. Since at time of publishing 2007 data was not yet complete, analysis of total waste generation for this year is not provided.
347. Consisting of mixed municipal waste, street cleansing residues, bulky waste and mixed municipal waste.
348. EEA 2005.
349. NSO.
350. EEA 2009.
351. ETC/RWM 2008.
352. <http://scp.eionet.europa.eu/themes/waste/#8>, accessed on 20th August 2009.
353. 94/62/EC.
354. <http://www.mrae.gov.mt>, accessed 8th November 2007.
355. Since at time of publishing 2007 data is not yet complete, analysis for this year for total construction waste generated is not provided.
356. This is any type of waste which is explosive, oxidizing, flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, teratogenic (causes malformations in a foetus), mutagenic (permanently alters the DNA) or ecotoxic.
357. In the future such waste will be able to be treated and disposed of safely in Malta in a new purpose-built hazardous waste engineered landfill.
358. This inventory was developed for reporting purposes through an EU-funded Twinning Light Project.
359. LN 344 of 2005 on the Abandonment, Dumping and Disposal of Waste in Streets, and Public Places or Areas Regulations, 2005.
360. EEA 2007a.
361. EEA 2007b.
362. Waste that is not hazardous but requires notification in line with EU requirements.
363. As of January 2009.
364. http://glossary.eea.europa.eu/EEAGlossary/search_html, accessed on 15th October 2007.
365. Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0096:EN:HTML>, accessed on 6th November 2009), amended by 2003/108/EC, transposed by LN 63 of 2007 under the the Environment Protection Act (Cap. 435) [Waste Management [Electrical and Electronic Equipment] Regulations, 2007].
366. http://ec.europa.eu/environment/waste/weee/index_en.htm, accessed 19th October 2007.
367. Waste that generates a large quantity of energy, such as wood.
368. WasteServ Malta Ltd.
369. WasteServ Malta Ltd.
370. Indeed, as discussed in more detail in the Chapter 3 on Climate Change, WasteServ Malta Ltd. has proposed to extract landfill gas from this managed landfill as a Clean Development Mechanism (CDM) project under the framework of the Kyoto Protocol in 2007. CDM allows countries party to the Kyoto Protocol to invest in projects that reduce emissions, which may then be claimed as credits that the country can use in order to reach its compliance target with respect to emissions or sell to other countries.
371. WasteServ Malta Ltd.
372. This project is co-funded through EU Cohesion Fund.
373. WasteServ Malta Ltd.
374. Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31979L0409:en:TML>, accessed on 6th November 2009), transposed by LN 79 of 2006 under the Environment Protection Act (Cap. 435) and the Code of Police Laws (Cap. 10) [Conservation of Wild Birds Regulations, 2006], amended by LN 39 of 2007.
375. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:html>, accessed on 6th November 2009), transposed by LN 311 of 2006 under the Environment Protection Act (Cap. 435) and the Development Planning Act (Cap. 356) [Flora, Fauna and Natural Habitats Protection Regulations, 2006], and amended by LN 162 of 2009.
376. CEC 1998.
377. CEC 2006c.
378. NSO 2008a.
379. This value was obtained using CORINE Land Cover Change maps (refer to Chapter 4 on Land), based on a scale of 5ha land parcels.
380. See Chapter 4 on Land.
381. With the exception of legitimate uses that require a rural location, such as agricultural buildings.
382. Note that as part of the local planning process, an exercise to rationalize the development zone boundary took place in 2006, which has resulted in a 2.3 percent increase in the development zone.
383. In accordance with Structure Plan Policy SET 11.
384. See Council Directive 90/219/EEC of 23 April 1990 on the contained use of genetically modified micro-organisms (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31990L0219:en:NOT>, accessed on 6th November 2009), amended by 91/448/EEC, 94/51/EEC, 96/134/EEC, 98/81/EEC and 2001/204/EC, transposed by LN 127 of 2008 under the Environment Protection Act (Cap. 435) [Contained Use of Genetically Modified Micro-organisms Regulations, 2008].
385. <http://mt.biosafetyclearinghouse.net/>, accessed on 10th June 2009.
386. Lanfranco 1999.
387. The Carnet de Chasse is a register in which the hunter/trapper keeps a record of what was captured during the year.
388. MEPA Carnet de Chasse database.
389. CEC 2006c.
390. MRAE 2004a.
391. EEA 2005.
392. MRAE 2004a.
393. Such as the Maltese Rock-Centauray (Palaeocyanus crassifolius Maltese name: Widnet il-Bahar).
394. Not all these species are reflected in the assessment underlying Chart 8.2, as explained in the Table.
395. 92/43/EEC. The status categories used are: Favourable; Unfavourable – Inadequate; Unfavourable – Bad; and, Unknown.
396. http://circa.europa.eu/Public/irc/env/monnat/library?l=/habitats_reporting/reporting_2001-2007/ms-reports_summaries/national_summarypdf_16/_EN_1.0_&a=d, accessed on 2nd September 2009.
397. http://circa.europa.eu/Public/irc/env/monnat/library?l=/habitats_reporting/reporting_2001-2007/ms-reports_summaries/national_summarypdf_16/_EN_1.0_&a=d, accessed on 2nd September 2009.
398. In line with the Habitats Directive (92/43/EEC).
399. In line with the Birds Directive (79/402/EEC).
400. This figure includes the Addolorata Cemetery and San Anton gardens. Such protection is also afforded to within 50 metres of any other cemetery in Malta and Gozo, as well as to all public gardens. For more information refer to LN 79 of 2006.
401. LN 39 of 2007.
402. Development Planning Act (Cap. 356) [and subsequent amendments].
403. This is a network of sites across the EU, designated under the Habitats and Birds Directives, which merit special conservation measures since they support habitats and species of community interest. For more information, see http://ec.europa.eu/environment/nature/natura2000/index_en.htm [accessed on 11th November 2009].
404. Automatically Natura 2000 sites, as provided for in the relevant legislation.
405. <http://dataservice.eea.europa.eu/atlas/viewdata/viewpub.asp?id=3640>, accessed on 15th June 2009.
406. These are Filfla, il-Gzejjer ta' San Pawl and Haġret il-General.
407. For details please see: <http://www.mepa.org.mt/info-annual-reports> [accessed on 11th November 2009].
408. For example, for fishing and hunting. The legal provision for fishing is the Fishing Conservation and Management Act (Cap.425) and for hunting, it is LN 79 of 2006 under the Environment Protection Act (Cap. 435) [Conservation of Wild Birds Regulations [Declaration of Open Season for Hunting and Taking of Wild Birds], 2006].
409. For example the taking, handling, possession, transport and trading of protected species are regulated through permits under LN 311 of 2006.
410. Such as rats and the Prickly Pear from St. Paul's Islands, and the Hottentot Fig (*Carpobrotus edulis*) and the Giant Reed (*Arundo donax*) from sand dunes.
411. The Yelkouan Shearwater project, run by BirdLife Malta, two other conservation NGOs and four government authorities, is a case in point (<http://www.lifeshearwaterproject.org.mt/>).
412. An example of such a re-introduction is that of the Sea Daffodil (*Pancratium maritimum*), which has been re-introduced in certain degraded beaches in Mellieħa. The Thorny Burnet (*Sarcopoterium spinosum*), a threatened plant species that exists as a small population in only one locality in Malta, has also been propagated to enhance its population.
413. See Chapter 4 on Land.
414. BirdLife Malta, in collaboration with the British Trust for Ornithology, has undertaken an island-wide survey of all Maltese breeding bird species, calculating in the process an important international indicator critical for understanding long-term population changes of rural bird species, the Farmland Bird Index.
415. <http://www.mepa.org.mt/biodiversity-protection>, accessed on 3rd November 2009.
416. Capleton et al. 2005.
417. Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme.
418. Council of the European Union 2006.
419. MHEC 2006.
420. http://www.enhis.org/object_class/enhis_air.html, accessed on 22nd November 2007.
421. See Chapter 2 on Air.
422. EEA 2007a.
423. EC 2007.
424. Carried out by an inter-agency working group made up of the Department for Environmental Health, MEPA and the AdT.
425. <http://www.ohsa.org.mt/showpage.asp?pageid=170>, accessed on 20th November 2007.
426. WHO Europe 2007a.
427. Commission Recommendation of 21 February 1990 on the protection of the public against indoor exposure to radon (90/143/Euratom) (<http://eur-lex.europa.eu/Notice.do?val=163076:cs&lang=sv&list=163076:cs,161414:cs,&p>

- os=1&page=1&nbl=2&pgs=10&hwords=, accessed on 9th November 2009).
428. MHEC 2006.
429. http://www.env-health.org/a/2641?var_recherche=ionising+radiation, accessed on 22nd November 2007.
430. Jamieson *et al.* 2007.
431. Biolinitiative 2007.
432. <http://www.who.int/peh-erhf/project/en/>, accessed on 22nd September 2009.
433. http://ec.europa.eu/health/ph_determinants/environment/EMF/emf_en.htm, accessed on 22nd September 2009.
434. See MCA's interactive website with information on monitoring of EMF at: <http://www.mca.org.mt/infocentre/openemf.asp>, accessed on 22nd September 2009.
435. <http://env-health.org/r/58>, accessed on 22nd November 2007.
436. See Chapter 2 on Air.
437. See Chapter 5 on Fresh Waters.
438. Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ.L:1998:330:0032:0054:EN:PDF>, accessed on 6th November 2009), transposed by LN 17 of 2009 under the Food Safety Act (Cap. 449) [Water Intended for Human Consumption (Amendment) Regulations, 2009], and amended by LN 242 of 2009.
439. WSC 2007.
440. WSC.
441. LN 17 of 2009.
442. High nitrate levels in drinking water reduce the oxygen-carrying capacity of blood, and are of particular concern for infants.
443. See Chapter 5 on Fresh Waters.
444. LN 17 of 2009.
445. LN 357 of 2004 under the Food Safety Act (Cap. 449) [Registration of Private Water Supplies Intended for Human Consumption Regulations, 2004].
446. DEH.
447. A private water supplier with more than one private water supply is required to register each and every water supply.
448. http://ec.europa.eu/environment/water/water-bathing/report_2009.html (accessed on 3rd November 2009), but see also Chapter 6 on the Marine and Coastal Environment.
449. CEC 2003.
450. EEA 2007a.
451. WHO Europe 2003.
452. http://ec.europa.eu/environment/pops/index_en.htm, accessed on 10th December 2007.
453. WHO Europe 2007b.
454. MEPA 2007d. The data in the report is a rough estimation of the dioxin/furan releases to the environment from incineration, ferrous/non-ferrous metal production, power generation, domestic heating, transport and open burning, waste disposal and miscellaneous sources. The accuracy of the releases is heavily dependant upon the availability of certain activity datasets. Where data was not available the calculation were based on a number of assumptions.
455. EEA 2007a.
456. Including the banning of the importation and manufacture of leaded paint for domestic use in 1984, a ban on the use of inappropriate fuel in bakeries in 1989, the introduction of unleaded petrol in 1991, and the banning of leaded petrol in January 2003.
457. M. Sammut, Toxicology Unit, Pathology Department, Mater Dei Hospital.
458. National Soils Unit (MRAE).
459. Regulation [EC] No 1907/2006 (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ.L:2007:136:0003:0280:n:PDF>, accessed on 9th November 2009).
460. Healthy Environments for Children Alliance (undated).
461. http://www.planthealth.gov.mt/Downloads/state_of_the_environment_report_2008.pdf, accessed on 28th January 2009.
462. Council Directive 91/414/EEC (http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi:celexapi:prod:CELEXnumdoc&lg=EN&numdoc=31991L0414&model=guichett, accessed on 9th November 2009).
463. CEC 2006d.
464. Regulation [EC] No 1907/2006.
465. Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0082:EN:HTML>, accessed on 9th November 2009), transposed by LN 37 of 2003 under the Occupational Health and Safety Authority Act (Cap. 424) [Control of Major Accident Hazards Regulations, 2005] as amended by LN 6 of 2005.
466. Establishments that fall under this Directive are divided into two categories, depending on the quantities of dangerous substances stored. Operators of lower tier sites have to fulfil certain obligations, such as having a major accident prevention policy in place, whereas operators of upper tier sites have additional obligations that include the implementation of a safety management system and emergency plan.
467. <http://www.euro.who.int/Noise>, accessed on 22nd November 2007.
468. <http://env-health.org/r/92>, accessed on 22nd November 2007.
469. EEA 2007a.
470. <http://env-health.org/r/92>, accessed on 22nd November 2007.
471. http://www.euro.who.int/Noise/Activities/20030123_1, accessed on 22nd November 2007.
472. A-weighted equivalent sound pressure level.
473. A-Weighting is the most commonly used frequency weighting network, utilised to approximate the frequency response of our hearing system (WHO 1999).
474. Maximum A-weighted sound pressure level in stated interval.
475. Peak sound pressure (not LAF, max) measured 100mm from ear.
476. Peak sound pressure (not LAF, max) measured 100mm from ear.
477. Confalonieri *et al.* 2007.
478. Ecofys BV 2006.
479. HEAL 2007.
480. MRAE 2004a.
481. See England (2009) and Spiteri (2009).
482. Confalonieri *et al.* 2007.
483. See Chapter 6 on Coastal and Marine Environment.
484. WHO Europe 1999.
485. WHO Europe 2007c.
486. Branca *et al.* 2007.
487. Grech and Farrugia Sant' Angelo 2007.
488. Currie *et al.* 2004, 2008.
489. WHO Regional Office for Europe (forthcoming).
490. WHO Europe 2006.
491. Edwards and Tsouros 2006.
492. Relative decoupling occurs when environmental damage increases at a slower rate than GDP, whereas absolute decoupling occurs when environmental damage decreases while GDP increases.
493. This chapter is based on a study commissioned for this purpose from Ernst & Young and Gordon Cordina (Ernst & Young Ltd. and Cordina 2008).
494. This is hereafter referred to as 'the environment'. Cultural heritage assets are also included as part of the environment if they are inextricably linked to the natural environment.
495. See Ernst & Young Ltd. and Cordina 2008.
496. However it is important to recognise that environmental values may conflict with each other, and also that economic activity may impinge on the environment in ways that could negatively affect the sustainability of its contribution to human welfare.
497. Option use value relates to the welfare created by the possibility to use a resource, even though it is not currently being utilised, while bequest value focuses on welfare derived from the knowledge that a resource is being passed on to future generations.
498. It is recognised that the sectors discussed under renewable resources may actually inflict non-reversible effects on the environment if managed in an unsustainable manner, through, for example, over-fishing, excessive groundwater abstraction and improper land use by tourism facilities. Thus the distinction between renewable and non-renewable resource use is often blurred in practice. An assessment of the practical sustainability of resource use by each sector of economic activity would perhaps be more appropriate, but this lies beyond the scope of this analysis.
499. Ernst & Young Ltd. and Cordina 2008.
500. Caruana 2005.
501. Camilleri Rolls 2006.
502. However based on use of the beaches in the summer period.
503. This estimate reflects the fact that the shorelines of Ramla Bay and Pretty Bay constitute 14 percent of the total shoreline length of bathing areas in Malta, including rocky beaches (MEPA).
504. This estimate is subject to the assumption that valuations for Pretty Bay and Ramla Bay can be extended to other bathing sites in Malta, and is also subject to the same limitations arising from the potentially high sampling errors in estimating the values of Pretty Bay and Ramla Bay. Furthermore, Ramla Bay and Pretty Bay are in different geographical areas and are both sandy beaches and may therefore not be representatives of other sandy beaches or indeed rocky sites.
505. This is because household consumption represents only part of total production based on environmental resources. Indeed, the direct use of resources through market arrangements for consumption purposes may already be reflected in the (more recent) GDP data presented earlier.
506. See Ernst & Young Ltd. and Cordina (2008) for methodological notes, including assumptions used and limitations to this analysis.
507. NSO 2007b.
508. Camilleri 2008 cited in Ernst & Young Ltd and Cordina 2008.
509. The discount rate is used in determining the present value of future cash flows.
510. NSO 2007b.
511. NSO.
512. Option use value and the bequest value refer to the welfare created by the possibility to use a resource, even though it is not currently being utilised, and the welfare derived from the knowledge that a resource is being passed on to future generations, respectively.

513. This estimate incorporates the fact that Pretty Bay accounts for five percent of the length of shoreline of bathing areas in Malta (not just sandy beaches) (MEPA).
514. NSO 2008i.
515. OECD 2007.
516. Ernst & Young Ltd. and Cordina 2008.
517. The General Government sector includes central Government as well as regulatory authorities (but not MEPA, which is classified as 'housing' under COFOG, since separate data for its environmental and planning expenditure is not submitted) and public sector environmental operators such as WasteServ Malta Ltd.
518. Ernst & Young Ltd. and Cordina 2008.
519. ECOTEC *et al.* 2001.
520. It would be useful to compare these benefits with the full costs involved for Malta to comply with the EU environmental acquis, including those incurred by the private sector, but no such overall estimate has yet been completed.
521. ETC 2008.
522. This section draws extensively on Ernst & Young Ltd. and Cordina 2008.
523. Ernst & Young Ltd. and Cordina 2008.
524. Ernst & Young Ltd. 2006.
525. These include Communications from the Commission.
526. These are operations the functioning of which are not of sufficient environmental risk to merit a full permit, but which could involve concerns relating to, for example, emissions and waste.
527. <http://www.mepa.org.mt/ipcc-applications>, accessed on 3rd November 2009.
528. Updated as of April 2009.
529. EC 2008.
530. EMCS 2008.
531. For example waste separation rates, use of public transport, and use of renewable energy in homes remain relatively low (see Waste and Driving Forces Chapters of this Report).
532. <http://www.ekoskolamalta.com/>, accessed on 3rd November 2009.
533. This number does not include other schools that may be implementing environment-friendly measures but are not participating in this programme.
534. http://www.birdlifemalta.org/teachers/dinja_wahda/, accessed on 5th November 2009.
535. CEC 2004, accessed on date (see websites).
536. <http://www.iso.org>, accessed on 18th March 2008.
537. These include: Elepac Ltd., General Soft Drinks Co. Ltd, Methode Electronics Malta Ltd., Baxter Ltd. and ST Microelectronics (Malta) Ltd.
538. http://ec.europa.eu/environment/emas/registration/sites_en.htm, accessed on 17th March 2008.
539. <http://www.msa.org.mt/emas/index.htm>, accessed on 16th September 2008.
540. EMAS Compass Plus (<http://emas-compass-plus.euweb.cz/>, accessed on 12th November 2009) and EMAS Easy (<http://www.emas-easy.eu>, accessed on 12th November 2009).
541. <http://www.blueflag.org/BlueFlagHistory>, accessed on 12th August 2008.
542. Malta Tourism Authority.
543. <http://www.eco-label.com/default.htm>, accessed on 9th November 2009.
544. MTA.
545. GPP ensures that public authorities integrate environmental criteria when purchasing goods, services and works.
546. A production system that minimises artificial inputs (for more information see <http://www.ifoam.org>, accessed on 19th August 2009).
547. MSA.
548. Based on agricultural area figure in 2007 (NSO 2008j).
549. MSA. See Chapter 4 on Land for more information on organic farming.
550. Meuleman *et al.* 2003. See also Principle 10 of the Rio Declaration (<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=78&ArticleID=1163>, accessed on 25th March 2008) and Paragraph 164 of the Johannesburg Plan of Implementation (http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm, accessed on 25th March 2008).
551. Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (<http://www.unepce.org/env/pp/documents/cep43e.pdf>, accessed on 20th February 2008).
552. LN 116 of 2005 under the Environment Protection Act (Cap. 435) [Freedom of Access to Information on the Environment Regulations, 2005]; LN 230 of 2004 under the Environment Protection Act (Cap. 435) [Integrated Pollution Prevention and Control (Amendment) Regulations, 2004]; LN 74 of 2006 under the Environment Protection Act (Cap. 435) [Plans and Programmes (Public Participation) Regulations, 2006]; LN 114 of 2007 under the Environment Protection Act (Cap. 435) and the Development Planning Act (Cap. 356) [Environmental Impact Assessment Regulations, 2007 Arrangement of Regulations].
553. Council Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:041:0026:032:EN:PDF>, accessed on 10th November 2009), and Council Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:156:0017:0024:EN:PDF>, accessed on 12th November 2009).
554. http://www.mepa.org.mt/tf06_aarhus, accessed on 12th November 2009.
555. <http://www.mepa.org.mt/access-info> [accessed on 3rd November 2009] and <http://www.mepa.org.mt/public-consultation> [accessed on 3rd November 2009].
556. MEPA 2008. The proposed environment and development planning act includes this change. (www.doi.gov.mt/EN/bills/2001/bill%2043%20mepa%20Eng.pdf, accessed on 26th February 2010).
557. NCSD 2006.
558. MFEI 2008.
559. <http://www.mepa.org.mt/permitting-ea-main>, accessed on 12th November 2009.
560. Note that the chart details the year in which the applicant was notified by MEPA that a particular applications requires an EIA.
561. It is worth noting that EIAs on minerals extraction facilities were still being required on applications that had been submitted prior to the moratorium in the period following the moratorium due the lead-time involved between submission of applications and commissioning of EIAs, due to preliminary stages of the EIA process such as screening and scoping.
562. <http://www.mepa.org.mt/permitting-ea-cons>, accessed on 3rd November 2009.
563. As of end 2008 EIA consultants had to be approved by MEPA prior to the commencement of the assessment. However in August 2009 Government issued guidelines on the registration of consultants who wish to work on EIAs, as stipulated under LN 204 of 2001 under the Development Planning Act (Cap. 356) [Environmental Impact Assessment Regulations, 2001], repealed by LN 114 of 2007 and amended by LN 425 of 2007, transposing Council Directive 85/337/EEC of 27 June 2005 on the assessment of the effects of certain public and private projects on the environment (<http://ec.europa.eu/environment/eia/full-legal-text/85337.htm>, accessed on 9th November 2009), amended by Council Directive (EC) 97/11/EC and Council Directive 2003/35/EC).
564. Special Areas of Conservation and Special Protection Areas.
565. LN 418 of 2005 under the Environment Protection Act (Cap. 435), transposing Council Directive 2001/42/EC (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:197:0030:0037:EN:PDF>, accessed on 14th February 2008).

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ACRONYMS

AdT	Awtorità dwar it-Trasport (Malta Transport Authority)
AQFD	Air Quality Framework Directive
BCC	Biosafety Co-ordinating Committee
CDM	Clean Development Mechanism
CEHAPE	Children's Environment and Health Action Plan for Europe
CFC	Chlorofluorocarbon
DDT	Dichlorodiphenyltrichloroethane
DEH	Department for Environmental Health
DMC	Domestic Material Consumption
EC	European Commission
EIA	Environmental Impact Assessment
EIPP	Environment Initiative Partnership Programme
EMAS	Eco-Management and Audit Scheme
EMF	Electromagnetic fields
ETS	Emissions Trading Scheme
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GMO	Genetically Modified Organism
GPP	Green Public Procurement
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbons
IPPC	Integrated Pollution Prevention and Control
ISO	International Organisation for Standardization
LUFLUF	Land Use, Land-Use Change and Forestry
MDH	Mater Dei Hospital
MEPA	Malta Environment & Planning Authority
MEU	Management Efficiency Unit
MITC	Ministry for Infrastructure, Transport and Communications
MRA	Malta Resources Authority
MRRA	Ministry for Resources and Rural Affairs
MSA	Malta Standards Authority
MSLA	Mean Sea Level Aquifer
MTA	Malta Tourism Authority

NEC	National Emissions Ceiling
NEHAP	National Environmental Health Action Plan
NGO	Non-Governmental Organisation
NH₃	Ammonia
NO₂	Nitrogen dioxide
NO_x	Nitrogen oxide
NPI	National Protective Inventory
NSO	National Statistics Office
O₃	Ozone
ODS	Ozone Depleting Substance
OHSA	Occupational Health and Safety Authority
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated biphenyl
PM	Particulate Matter
POP	Persistent Organic Pollutant
RE	Renewable Energy
REACH	Registration, Evaluation, Authorisation & Restriction of Chemicals
RES	Renewable Energy Sources
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SO₂	Sulphur dioxide
SPA	Special Protection Area
TSE	Treated Sewage Effluent
UCA	Urban Conservation Area
UIF	Urban Improvement Fund
UN	United Nations
UNFCCC	United Nations Convention on Climate Change
UoM	University of Malta
UV	Ultraviolet
VOC	Volatile Organic Compounds
WFD	Water Framework Directive
WHO	World Health Organisation
WSC	Water Services Corporation



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