An Integrated Approach towards Assessing Public Attitudes regarding Domestic Water Conservation in Zejtun and Birkirkara

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To my parents – Joseph and Elizabeth,
who always encouraged me through these years....

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List of Abbreviations

ADB	Asian Development Bank
B'Kara	Birkirkara
c	Cents
EU	European Union
FAO	Food and Agriculture Organization
GWP	Global Water Partnerships
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
Lm	Maltese Lira
MEPA	Malta Environment and Planning Authority
Mgd	Million Gallons per day
MIA	Malta International Airport
m	metres
mm	millimetres
MRA	Malta Resources Authority
MSSD	Mediterranean Strategy for Sustainable Development
MWGWR	Multilateral Working Group on Water Resources
NGO	Non Governmental Organisation
NSO	National Statistics Office
Pg	Page
RO	Reverse Osmosis Desalination
RWH	Rainwater Harvesting
TAC GWP	Technical Committee of the Global Water Partnership
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environmental Programmes
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
USA	United States of America
UV	Ultra Violet
WFD	EU Water Framework Directive
WHO	World Health Organization
WSC	Water Services Corporation
%	Percentage

Abstract

This dissertation 'An Integrated Approach towards Assessing Public Attitudes regarding Domestic Water Conservation in Zejtun and Birkirkara,' has been carried out for two main underlying objectives - first is that, within the Maltese context, despite Malta being a major water scarce country in the world, water resources are not appreciated enough. Second, is that although water conservation methods are practised within certain parts of Malta, as a general rule, water conservation methods are not fully implemented. Thus, water conservation is an under-utilised technique.

After introducing the notion of water conservation, and contextualising the subject within the parameters of the Maltese society, a literature review focuses on a number of meaningful implications related to water conservation, for instance reducing the water consumption levels by simple strategies and using a well. This expounds universal scientific principles, and later on these are applied within the local context.

The next section focuses on the methodology. In this context both quantitative and qualitative research methods are going to be employed, so as to make sure it is scientific as much as possible. The results of the interviews of Zejtun and B'Kara are compared, so that one can assess research outcomes in objective critical terms. The literature findings are presented in the later chapters, and they are interpreted in line, with the literature review, and the mindset of the respondents themselves.

Finally, the last chapter is a conclusion so as to round off the dissertation, highlighting a number of recommendations, so the effective water conservation methods can be effectively implemented within the Maltese context in the near future.

Chapter 1
The Need for Water Conservation

1.1 Introduction

Water is a vital chemical substance, its conservation and utility demands "a shared responsibility," essential to all known forms of life. Water is equally essential in facilitating material progress. Subsequently, this chemical has impact on all known human activity, (Harvey, 1966). Thus its sustainable management demands the necessary strategies, essential in protecting the water environment and is imperative to meet both current and future demands (www.waterconservation/defra.uk).

In typical usage, water refers only to its liquid form or state, but it can likewise be available in other states. Clean, fresh water is essential to human and other terrestrial life. In many parts of the world, it is in short supply. Water being a *res communis,* of which every person is a consumer, increases the responsibilities towards this vital life asset. Thus the utility of water must be 'governed' by a rational programme with the underlying objective to avoid all waste and to make optimal use of nature's resources, (Schlottau, 1966).

1.2 Water as a Strategic Resource

Although unevenly distributed, the world has plenty of fresh water. However, due to mismanagement, limited resources, environmental changes, overpopulation, mass consumption and the impacts of water pollution – these factors inevitably diminish the availability of fresh water per capita, which is inadequate and shrinking rapidly. Water is a *strategic resource* worldwide, and an important element within many political conflicts. Some have predicted, that clean water will become the "next oil", possibly making Canada, where this resource in abundance, the richest country in the world, (www.discoverychannel.com). There is a long history of conflict over this "strategic resource", including efforts to gain its access together with tensions over shortages and controls.

Moreover climate change, population growth, structural changes within the household and economic development, have over the past 50 years tripled the demand for water. Thus water quality is declining within most regions. Empirical evidence indicates that the diversity of freshwater species and ecosystems is rapidly deteriorating. In view of this the adoption of efficient water use patterns is indispensable, (www.waterconservation/defra.uk). In order for these efficient water use patterns to be integrated within the society, "*Good governance is essential for managing our increasingly-stretched supplies of freshwater.*" Local, national and regional institutions serve as strong and legally effective frameworks indispensable in providing sufficient human and financial resources essential in recovering the situation, (UNESCO Director-General Koïchiro Matsuura - http://www.unwater.org/wwdr2-news2.html).

1.3 Water Conservation – An Indispensable Approach

Water conservation represents the most cost-effective and environmentally sound way to reduce our demand for water. This can be done by fostering 'healthy water conservation

habits', stopping wasteful uses, decreasing peak consumption, and charging for water at the appropriate rates. Water conservation takes advantage of technological developments and improved management techniques. Other subsidiary benefits include coordinating water resource planning; land-use management, economic and socio planning; and the establishment of new or updated standards and regulations. In short, water conservation conduce optimal water use, (Encarta, 2000).

Water conservation refers to an educational process concerning, the effective use of fresh water, through technologically or socially acceptable methods. Within its broad context water conservation can be defined as:

1. Any beneficial reduction in water loss, waste, or use;
2. A reduction in water use accomplished by implementation of water conservation or water efficiency measures; or
3. Improved water management practises that reduce or enhance the beneficial use of water, (http://worldwaterconservation.com/).

A water conservation measure is an action or behavioural change. Over the past decades, technology, improved design or processes have been implemented, so as to reduce water loss, waste, or use. This results in more efficient water use and thus a substantial reduction as regards the demand for water. Conservation encompasses the collection of rainwater within small tanks primarily for domestic use. Other activities include the construction of reservoirs or wells, the recharging of the groundwater tables, the using of lower quality water and whenever possible saving good quality water. The goals of water conservation efforts can be highlighted hereunder:

- Sustainability: To ensure availability for future generations. The withdrawal of fresh water from an ecosystem should not exceed its natural replacement rate.
- Energy conservation: This is indispensable for water pumping, delivery and wastewater treatment facilities consume a significant amount of energy. For instance

in California, over 15% of the total electricity consumption is devoted to Water Management.

- Minimize human water use, thus helping to preserve fresh water habitats for local wildlife. Thus habitat conservation is linked directly with water conservation, (http://en.wikipedia.org/wiki/Water_conservation).

Water conservation and management consists of a set of interlinked processes including water collection and prevention of flooding. The latter can be achieved by the public backed by political will - both of which require technical and financial funds, (Skinner *et al.*, 2000). Another technique that is efficient in tackling water conservation is the harvesting of rainwater. Prinz (1996) defines RWH as

"...the utilisation of surface runoff; therefore it requires runoff producing and runoff receiving areas. ... Water harvesting projects are generally local and small scale," (Cardona, 2006).

Governments have a full responsibility in achieving effective water conservation. It is imperative that adequate water control laws within a legal framework, an educational campaign and a cost-benefit appraisal are adopted. This can be only successfully attained whenever backed by rigid enforcements by employing additional enforcing officers. The latter increases the cost of operation. Greater expenditure will arise from the construction and maintenance of reservoirs, storage tanks, pumping equipment and piping systems. In the past engineering skills were considered to be important. Today, a more holistic approach to water conservation needs to be attained, by, considering a multi-sectoral and multi-disciplinary approach to water conservation. In order to successfully obtain the above, professionals from natural scientific backgrounds such as, geographers are indispensable while engineers only play a minor role.

It has long been recognised that the exercise of water conservation practices is beneficial in stretching water supplies and protecting water quality. The difficulty has been in getting

people in accepting and employing innovative technologies. To commence this harvesting, there is the pressing need for multiple-purpose planning and management at a local level. This incorporates functions relating to water quality, water supply, water reuse and conservation, urban drainage and not the least land-use planning, (Whipple, 1978). Conservation of water was initially associated with projects which generate economic benefits, or alternatively with the industrial prosperity that would accompany hydroelectric power development. Others were associated with the security of life and property through flood control. Today, conservationists grant full recognition to the 'material contribution' use of water, indispensable in transforming a state's economy. However they are beginning to recognize the importance of the attachment people have towards water within the emerging leisure industry. Water conservation is not an assault against nature's hydrological cycle, (G. Harvey, 1966). Its effective harvesting is helping in conserving part of the nature, instead of being wasted.

1.4 The need for Water Conservation in the Maltese Islands

Malta, a small island nation comprises an archipelago of seven islands, located 35°53N and 14°30E in the centre of the Mediterranean Sea (Figure 1.1). The archipelago comprises a total area of 316 km^2 and has a population of over 404,000 inhabitants, (NSO, 2006). The latter makes it one of the most densely populated countries in the world, (UN, 2005).

With a total average precipitation of 530mm per annum, Malta has a water availability of 40m^3/capita per year. Thus, it is amongst the lowest in the world, (Cardona, 2006). However 80% of the rainfall is evaporated, 14% goes into the sea, while 6% is surface-run off. The latter accumulates at the 'discharge point', which is at the Grand Harbour, since the islands are tilted towards the North East. This explains why B'Kara, Msida, Qormi and Marsa are more

prone to flooding. Other localities such as Zejtun, Mellieha and Dingli, on the other hand, register no flooding.

Figure 1.1: A map of the Maltese Islands
Source: Magellan Geographix, 1997, (www.maps.com)

This research focuses on Water Conservation within the localities of B'Kara (figure 1.2) and Zejtun (figure 1.2) in order to identify and explain the difference.

Birkirkara (or B'Kara) is a town of 21,775 inhabitants (November 2005) situated in the North East of Malta, while Żejtun is a medium sized town in the South East of Malta, which has 11,425 inhabitants (as per 2005 census), with 13,133 inhabitants projected for 2010.

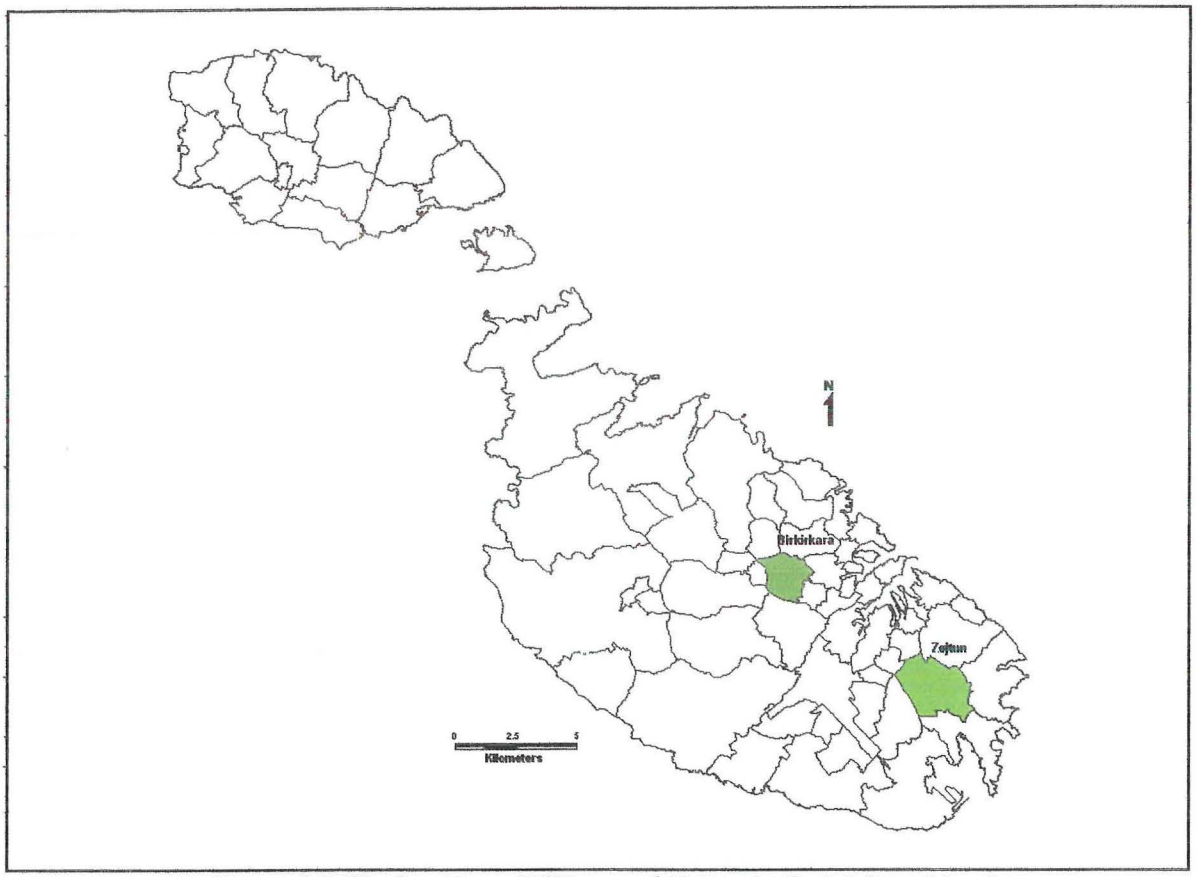


Figure 1.2: The location of B'Kara and Zejtun in the Maltese Islands
Source: Cardona, 2007

Water supply poses a problem within the Maltese Archipelago. The summer is both rainless and it is the time of highest water use. During winter, rainfall often falls as heavy showers, and it runs off to the sea, rather than soaking into the ground. Rainwater is the sole natural source of freshwater on the islands, with the two aquifers which are the Mean-Sea Level and the Perched Aquifers. Subsequently, Malta depends heavily on underground reserves of fresh water.

More than half the potable water of Malta is produced by desalination (figure 1.3), which creates further issues of fossil fuel use and pollution. The latter is due to the increasing deterioration of groundwater quality. Over the last few years, due to the Drinking Water Directive (98/83/EC), there has been the increasing need to produce high quality water. RO desalination is gradually taking over groundwater production. Moreover RWH and unconventional sources only account for 7% and 3% of total water production respectively, (Cardona, 2006).

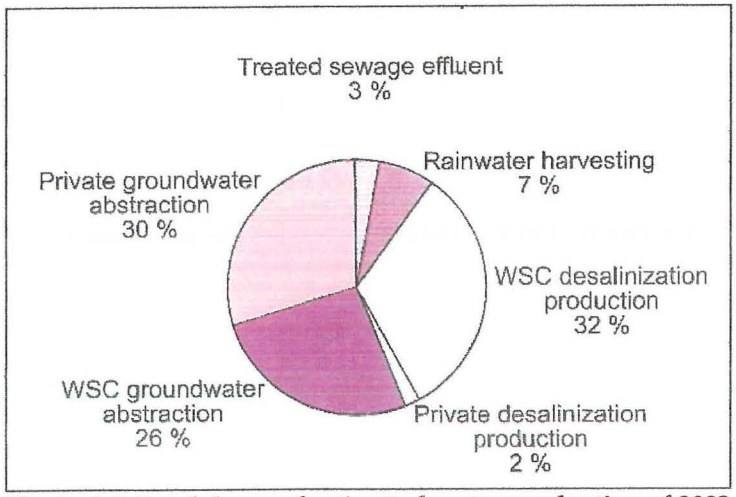


Figure 1.3: Breakdown of estimated water production of 2003
Source: FAO, 2006, pg. 35

The protection of the environment is one of the major challenges faced by the EU. Unfortunately, the environmental considerations including water are positioned in an inferior priority - below economic development - which is further impacting the environment in a detrimental way, (FAO, 2006). Water pollution is one of the 200 pieces of legislation, and in an area of water pollution like Malta, a number of Directives have been adopted to introduce water quality standards. These target drinking water, bathing water, water for fish farms and shellfish culture. Malta is committed to ensure sustainability regarding the scarce water resources in a holistic manner. This is attained thanks to its national legislation in the process regarding its accession within the EU. Sustainability, in this respect can be achieved by the agreements and measures that have been agreed before entering the EU, such as:

- By March 2007 waste water treatment plants in Malta and Gozo need to purify all Malta's sewage, (Europe: Your Government's Proposal, 2004).
- To improve 'quality drinking water', the level of nitrates and fluoride in tap water will be reduced by the end of 2005, (Europe: Your Government's Proposal, 2004).
- Pre-accession EU funding will help build the first Waste Water Treatment plant in Gozo over 2005 and 2006, (Europe: Your Government's Proposal, 2004).
- Waste water infrastructure was needed to be completed until March 2007, (Europe: Your Government's Proposal, 2004).

- Malta can save between Lm5 million (€13million) and Lm19.6 million (€47 million) every year if it applies EU standards on water quality, (Europe: Your Government's Proposal, 2004).
- It was supposed that by March 2007, sewage and dangerous substances can no longer be dumped into the sea, (Europe: Your Government's Proposal, 2004).

1.5 Water Conservation Methods - A Historical Perspective

The water problem has been for centuries one of the crucial bottlenecks. Malta has scanty rainfall, no rivers, no lakes, no artesian wells, only a few springs, a high rate of evaporation, and very little means of retaining the rain water stopping it from flowing seawards, (Azzopardi, 2002).

Historically, Malta has had a lack of natural resources in relation to demand. Water resources have always been considered of 'strategic' importance. Near the World Heritage of Hagar Qim and Mnajdra, there is a group of rock-cut cisterns known as the Misqa Tanks shown in Plate 1.1, (FAO, 2006).

Plate 1.1: The Misqa Tanks
Source: FAO, 2006

This problem concerning the availability of water and water conservation has certainly not arisen today. Before the Order of the Knights accepted to take over the rule of the country, (16th century), the Commission sent a report that the Maltese Islands 'suffer' from dryness and a critical lack of water supplies. In the building of Valletta, no private house was to have

a garden, so that water would not be needed for watering the plants. Every house was to have a well.

A topic highlighting rainwater conservation was reported on the Daily Malta Chronicle of 1905 stating that, *"We have sometimes asked ourselves what proportion of all the water that falls from the sky upon Malta is retained in the island. The answer might lead to most beneficial practical results and not long ago the minds of many in Malta were painfully occupied with the question: how long would our water last, if rain does not soon fall?"* (The Times, December 2005, pg. 32)

Various Administrations have been tackling the problem of water supply and provision by building more and larger reservoirs. Other indications include building more holes and looking for underground storage of water, apart from transporting water from places of surplus to deficiency areas. Other steps include undertaking extensive repair work and stopping leakages, installing desalination plants, installing various reverse osmosis plants and disseminating educational propaganda against water wastage. Hotels and factories need to be persistently encouraged to have their own water supply, thanks to their private small desalination gadgets.

Throughout the past decades, there was a huge concern about water issues, because water resources used to be safeguarded to a high degree. However, due to the absence of enforcement measures, the situation is now changing. It must also be concerned, that the building of so many apartments, rather than separate houses, makes the construction of wells rather challenging and thus families must be motivated to have their own cistern, (Azzopardi, 1995). Unfortunately, this law is today honoured more in its breach than its observance. Wells are today more commonly found in old houses rather than the modern counterparts.

Since water is no longer considered as a renewable resource, millions of litres of water will continue be wasted within our island, and if this situation is not changed our water supply

will further diminish. An emerging water crisis will make people suffer critically. The scarcity of water has become more acute within the contemporary context. This is due to the development of personal and domestic hygiene and sanitation, the ever increasing influx of hundreds of thousands of tourists, the continuous need of water for industrial use, coupled with the constant digging of illegal boreholes, (Anton Azzopardi, 2002).

WSC figures indicate that the consumption of water exclusively for domestic purposes was 142litres/person/day in 2000/01. Further figures regarding water consumption increase with the unregistered usage added with them can be shown in Appendix I, (FAO, 2006).

1.6 Research Aim and Objectives

The principal Aim which forms the basis of the hypothesis within this dissertation is that 'There is lack of public awareness on water conservation in homes and this does not vary between Local Councils'. This aim assesses, public awareness concerning water conservation for domestic uses, and whether this varies between the two localities under review. In order for this aim to be tackled holistically, the following key objectives for the successful evaluation of water conservation were identified:

- Whether social and socio-economic factors such as age, gender and occupation influence water conservation.
- Whether the general public attitudes reflected through public opinion and different media, influence public awareness on water conservation.
- Whether the present state of Water Resource Management in Malta, influences attitudes towards water conservation.
- Whether the natural induced floods affect people's perceptions on water conservation.
- Whether no consensus between policy makers and decision makers.

- Whether lack of water conservation arises due to physical constraints of space and mismanagement of water resources by politicians.

1.7 General overview of this research

This thesis 'An Integrated Approach towards Assessing the Public Attitudes regarding Domestic Water Conservation in Zejtun and B'Kara', seeks to evaluate water conservation in the local context from a number of dimensions, which are going to be evaluated chronologically.

Chapter 1 presents a general introduction on water related issues within the local context, so as to 'position' the research so that a more insightful appreciation can be attained.

Chapter 2 focuses on a detailed literature review of diverse case studies concerning water and its conservation. Although references to diverse foreign sources have been carried out, application to the local context has likewise been enacted. The methodology is expounded in Chapter 3. 300 interviews have been conducted at the localities of Zejtun and B'Kara. An assessment of the interview design is presented.

Chapter 4 and 5 devise the interview within two sections. The socio-economic sectors, inline with water awareness issues on the part of the Maltese civic public are evaluated in depth in Chapter 4. Moreover, Chapter 5 presents a broadly defined integrated approach to water resource management. These focus on feasibility studies targeting both political issues in line with the public opinion. The public opinion in this respect was viewed as being imperative so as to tackle water related issues from the grass roots. These include diverse aspects foremost of which are finance and education.

Chapter 6 presents a holistic approach, concerning how the country can adopt the necessary steps in order to maintain the quality of its respective water. The latter must be carried out in line with different stakeholders' agreements, together with plans for both conserving and purifying water.

1.8 Conclusion

Water conservation is available at people's houses and other infrastructure, improves the state of the environment, the standard of living and the general 'quality of life'. Water impacts our life directly and indirectly, since if water quality is not adequate in meeting people's needs, or alternatively if water quantity is not sufficient, conflicts are bound to arise, (APS Bank, 2007).

Chapter 2
A Theoretical Perspective of Water Conservation

2.1 Introduction

Water is a natural commodity, indispensable to life but limited in quantity. The demand for water is growing and the pollution of water by man is likewise increasing. The prosperity of a community, in fact its very existence depends upon an adequate supply of good drinking water. The settlement of people in certain districts of the earth's surface has been determined by available patterns and accessibility to water supplies, (Zammit, 1931). Rivers acted by tradition as magnets for settlement (Jackson, 1978). Even so the distribution of fresh water resources on the earth is unevenly distributed. Water is not always available, neither is its flow regular nor constant. Demand outstrips supply. When the demand is at its peak, the supplies are at their lowest, *(Schlottau in* EC, 1966).

Apart from quantity deficiencies in the global freshwater balance, quality has increasingly become a major concern. Industrialisation and urbanization brought significant changes resulting in severe pollution of water resources, (Jackson, 1978). Consequently available water resources have become, no longer sufficient in meeting human needs. At the present rate of consumption within industrialised countries, demand is steadily increasing with the increase in global populations and the quality rapidly deteriorating (Harvey, 1966). Eighty

countries worldwide report critical water shortages. People lack access of safe drinking water and 25,000 people die every day from water related diseases. Water-borne diseases are responsible for 80% of illness and deaths within the Developing World, killing a child every few seconds. These problems are found mostly in Africa and Asia and if this situation continues without any constructive action. Water scarcity and stress are two predictable phenomena for 2025, (Gordon Knox, personal communication).

2.1.1 The Water Cycle systems

Water is self-cleansing and constantly being recycled through the system of the hydrological cycle. In terms of total volume, 97.5% of the world's water is saline. 2.5% is in the form of freshwater, classified as 68.9% glaciers, 30.8% groundwater and 0.3% lakes and rivers, (Gordon Knox, personal communication). Not all the fresh water is readily available for use by humans, because it is either far too underground for tap to reach economically or else forms the frozen ice caps of the Polar Regions and high mountains.

2.2 Water Usage

For centuries, mankind throughout the world has spoiled and wasted water – one of his most precious birthrights. Man and not nature is largely at fault, because he continues to waste water available at his disposal. Water pollution implies that it is no longer suitable for human consumption, (Harvey, 1966). Water is becoming scarcer because man has polluted the air and caused climatic change and global warming further impacting the ongoing water crisis, (Gordon Knox – personal communication).

Harvey in 1966 stated that, *"water is frequently considered limited in supply and mankind has never tried smart conservation strategies."* In the past decades water was already restricted to its

use, but time showed improvements in this issue. Empirical evidence indicates that within developed industrial countries and developing states, water is predominately employed primarily for industrial followed by agricultural uses. Only a marginal percentage is employed for the primary sector.

2.3 Water Conservation and Management at the International Level

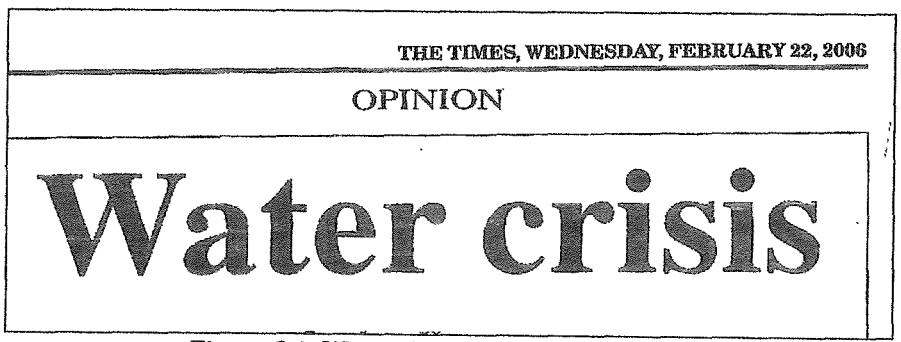
The UN General Assembly, in December 2003, proclaimed the years 2005 to 2015 as the International Decade for Action 'Water for Life', (UN-water.com). The primary goal of this decade is to promote efforts fulfilling international commitments targeted to water and water-related issues by 2015. These include the Millennium Development Goals, whose objective is to reduce by half the proportion of people without access to safe drinking water by 2015. Another aim is to stop the unsustainable exploitation of water resources, (UN-water.com).

Water meets a basic human need, and access to minimum quantities of safe water that is 20 litres per person per day should be everyone's right. Lack of access to safe drinking water, sanitation, and irrigation is directly related to poverty and ill health. For example, within Southern Asia, 300 million people have no safe drinking water, (WWC, 2000).

According to the World Water Day, two buckets of safe water a day is the minimum a child needs to live, (unicef.com). However, 4000 children die everyday, because their needs are not satisfied. UNICEF works energetically worldwide installing latrines and pumps. However, 1.1 billion people still drink unclean water. Basic sanitation and hygiene education has a dramatic effect on reducing mortality and poverty, (unicef.com).

The 'Water for Life' Decade was launched on 22nd March 2005, by the UN Secretary-General Kofi Annan. He stated that although water is essential for life, millions of people worldwide are still facing water shortages, as shown in the newspaper cut in figure 2.1. Millions of children die every day from water-borne diseases. Thus, sanitation must be a priority and drought is still affecting many of the world's poorest countries - the Sub-Sahara region. Strategists need to increase water efficiency, especially in agriculture. The civic society needs to be more involved in decision-making concerning water management so that the problem will be effectively tackled from the grass roots levels. According to Kofi Annan, water resources must not be a source of conflict, but must serve as a catalyst for cooperation. The year 2006 marks 'Water for Life' so that the nations worldwide can fulfil such goals in meeting the internationally agreed targets for water and sanitation by 2015. Thus further progress is expected to be carried out in the future years.

> *"This is an urgent matter of human development, and human dignity. Together, we can provide safe, clean water to the entire world's people. The world's water resources are our lifeline for survival, and for sustainable development in the 21st century. Together, we must manage them better."*
> Secretary General Kofi Annan, (UN-water.com, 2006).


THE TIMES, WEDNESDAY, FEBRUARY 22, 2006

OPINION

Water crisis

Figure 2.1: Water Crisis Worldwide
Source: The Times, February 22nd, 2006

Two goals were adopted with the aim to develop an IWRM and water efficiency plans, at the World Summit in Johannesburg in 2002, (author's notes). However such plans to succeed, must be realistic, financially feasible and within a specific time-frame. It is important to monitor and review the actions taking place and whether they are successful or not. A plan

must be well-prepared by the respective professionals who enjoy full knowledge. Moreover risks and contingency measures must be identified. For plans, to be implemented there is a need for political support to ensure the necessary funds and possibly a supporting legal framework. Plans that are prepared and implemented without public involvement in a democratic society remain shelved or worse still elicit a lot of opposition. Shelving projects only mean wastage of public funds. Although public participation and public consultation is a lengthy process, it represents a sound investment towards successful implementation of decisions and plans, (author's notes).

'Top-down' or 'bottom-up' approach are two effective forms of participation that decision makers and the general public undertake in discussing actions to be held. Absolute consensus cannot be attained because every person has his subjective view point. The most important factor is that the public has been consulted, and participated within decisions, targeted in building a holistic approach. The public and politicians must reciprocally coordinate. Participation, on the part of the civic pubic raises awareness which in turn, demands effective implementation, (author's notes).

Communities, businesses and governments around the world are encouraged to 'think globally and act locally' helping to conserve the environment such as planting trees, implementing energy and conserving water, (The Sunday Times, April 30, 2006). A typical example for ambitious water conservation project is being implemented in New Zealand, where a large percentage of people collect rainwater from house roofs. It is a reliable supply for drinking according to the WHO Drinking Water Guidelines. This is a simple measure that improved the water quality dramatically. Out of New Zealand's population of four million, 10% receive their water from, boreholes, surface water and roof water catchment, (Water Management Proceedings, 158, 2005).

2.4 The Mediterranean context – Emerging Water Problems

A grim picture of the future of the Mediterranean Region has been painted by a 400-page UN-Commissioned Report (UNEP), which warns of oncoming water shortages and unsustainable practices. Water shortage is calling for constructive actions and strategies in building responsible, united and dynamic Mediterranean, recommending a number of solutions to design the future for the 430 million inhabitants. Managing water demand could lead to major progress attained within a short time span relatively by limiting losses and the inappropriate use. This is reinforced further by ensuring more efficient use. Demand management could lead to savings of 24% in total demand in all Mediterranean countries by 2025, (The Times, 2006a).

Individuals, governments, organizations, NGO's, politicians, and the EU legislation, can improve this ever expanding-problem of water scarcity in the Mediterranean Region, particularly in the North and South (North Africa, Middle East), Mediterranean countries. Subsequently they design policies, strategies, enforce laws and make legislations to conserve, manage and harvest water. Individual effort is fundamental to diminish this, but without political will no constructive action can be implemented. Water can be a political agenda with the help of the public. Thus, public participation and consultation is an important step. Throughout the preparatory process of the MSSD, importance was given to the participatory approach and numerous technical reports were prepared and workshops organised. 'Integrated Water Management' part of the 'Integrated Management of Natural Resources' was one of the 'Priority Fields of Activities for the Environment and Development' in the Mediterranean Basin (1996-2005) adopted in 1995. In order to promote:

- Water resources protection and anti-drought measures
- Rational water demand management tools

- The establishment of national water resources quality and quality monitoring systems
- Appropriate treatment and reuse of waste water and saline water, (www.semide.net/initiatives/map/MSSD).

According to Agenda 21, decision-making can be strengthened with the participation of the public, females, youths, NGO's and indigenous people. This is a way to walk towards Sustainable Development.

2.5 The Maltese Scenario

The population within the Maltese Islands is increasing at a rate of about 2,400 inhabitants per year. The archipelago is poorly endowed with freshwater resources. Official statistics indicate that the Maltese population is expected to continue growing for the next 20-year period to a total of 425,000 inhabitants. This increase will impose further pressures on the socio-economic structures of the country, with significant added strains on the water resources, (FAO, 2006).

It is expected that the total number of households will increase, a change that will be accompanied by a decrease in household size. The latter will generate a higher level of water usage and consumption, (FAO, 2006). This precious resource of fresh water is becoming more limited, and is taken for granted in most cases. While many areas of the Developing World lack supplies of safe drinking water, waste in Malta is higher since it moves down the drain. Water is considered by the UN to be a major issue for the 21st century, (www.un.org).

Water is both an *economic* and a *social* good so directives such as the WFD are published and implemented within the Maltese context in coding policy laws and civil codes. The EU

Legislation has certain Directives such as the Groundwater, Drinking Water, Bathing, Habitats and Water Framework Directives. These directives are all integrated in the WFD, and it focuses on surface, groundwater, coastal and transitional waters. By the year 2015, all the water bodies within the Maltese archipelago must have optimal quality of water to meet the needs of everyone, (FAO, 2006).

Urban development in Malta has increased dramatically over the last 50 years, and this development has altered the physical characteristics of the landscape drastically. This has been due to a reduction of the infiltration process and the natural groundwater recharge, (FAO, 2006).

Meeting escalating demand for water, while protecting and conserving the resource base and the environment, is a major challenge. There are no surface waters that can be exploited economically. Groundwater resources are subject to increasing competition. Historically, the Maltese people have coped with water scarcity through rationalization limiting allocation of water per person. However, in recent decades, urban water users have not experienced prolonged periods of water shortages because of the good supply-reliability from desalination plants. Since the latter have ensured reliability of supply, it encouraged a "water" culture is encouraged that takes only limited interest in conservation or efficient use of water resources, (FAO, 2006).

Conserving water domestically not only saves money, it also helps protecting the environment and subsequently, the rural sector. When water is utilised, it is being 'borrowed' from the environment, before it is returned to the surrounding Mediterranean Sea. The less water is utilised, the less it is borrowed. Therefore, the unique water environments will remain healthy for future generations. In February 22nd, 2006 Gordon Knox stated in an article in 'The Times' that, "*Malta is heading for a crisis unless attitudes to water management and conservation change drastically.*"

In this perspective, Marco Cremona stated that by using the Rainwater Reuse System (Appendix II), a typical family of three to four may be self-sufficient for their water needs for seven months and pay Lm22.19c instead of Lm93.91c on bills per year, at present in WSC tarrifs (16c5 per person for the first 11 cubic metres consumed and Lm1.10c for each above 11 cubic metres plus a 55% surcharge). This would mean saving Lm71.72c, (The Times, 14th January, 2006, pg.24).

Heavy rainfall can contribute to flooding in high risk areas so the conservation of freshwater resources must be improved worldwide. This ensures that clean drinking water does not become a 'luxury product'. Everyone can start at home with a rainwater harvesting system, and this will save up to 50% of domestic water consumption. Rainwater can be used safely to flush toilets, wash clothes and water one's garden, (www.rainharvesting-waterconservation.com)

2.6 Ground Water is Under Threat

According to the State of the Environment Report 2005, Malta's ground water is seriously at risk from over-exploitation and pollution. 30% of the water production extracted in 2003 from the private sources, yet no one registered within the Health Department that this water was being used for human consumption. Water consumption rose by 8% between 1998 and 2004, (Grech, 2006). While between 1995 and 2003 the WSC decreased water loss by 53%, (L-Orizzont, 2006).

If Malta's water resources are to be protected, some critical decisions will have to be enacted in the very near future. To be successful, these decisions must impact the patterns of groundwater abstraction and commercial practices, which are currently degrading the quality of water resources. Political imperatives for such actions include:

- The large increase in domestic water bills
- The gradual collapse and/or major reduction in the profitability of irrigated agriculture. This will result from further the degradation of the sea-level aquifers
- The penalties of the EU Directives concerning water and the environment

Malta has no national water law so far. However, as single policy initiative that is well formulated, it could prompt the crucial changes in both attitudes and behaviours needed at all levels, in safeguarding the water-resources and to become a component of political decision-making. In Malta, the pricing of water supplied by the WSC is a political issue. EU member states are to ensure that by 2010, water-pricing policies provide adequate incentives for users in order to make efficient use of water resources for the country's welfare, (FAO, 2006).

2.6.1 A Water Engineer Perspective regarding Water problems and solutions

Over the past years, the Maltese public authorities focused only on the social implications of water-pricing policies, and on ensuring regular water catering for both domestic and industrial needs. There was no systematic attempt to encourage water conservation to avoid unnecessary consumption. Today, however ongoing studies in new technologies that augment water supply, through water conservation are being conducted. Storm water collected within reservoirs and dams can be turned into 'high quality' potable water. Storm water flowing in streets and in valleys after rain, is channelled to the sea as fast as possible, thus preventing flooding. However approximately 1.3 cubic metres of storm water, can be used in generating less electricity in the country from the reverse osmosis plants. According to a current study carried out by Engineer Cremona (Farrugia, 2006), storm water resulted in good quality potable water, with a miniscule amount of impurities suspended within it.

The potable water produced can supply around 35,000 people each year. Converting storm water to potable water is a completely novel idea, and a worldwide search for similar studies and tests only came up in Pittsburgh, United States. The underlying objective concerns with the treatment of storm water in preventing pollution of water bodies, (Farrugia, 2006).

In both industry and agriculture, the water supply extraction is at times illegal. However over the months, there has been greater awareness of the need to use water optimally, and channel the consumption of this resource to its highest economic value, by the WSC. The outstanding bills are collected to introduce accountability in water consumption, to generate an effective cost-recovery system, and to introduce widespread conservation attitudes and habits, (FAO, 2006).

2.7 Alternative Water Harvesting Systems

Over the past two years the ministry has drafted a flood relief project which consists of, designs in building a cylindrical tunnel beneath Mosta, Naxxar, Iklin, Birkirkara, Msida and Lija. The objective behind this project is to collect and dispose storm water which could be used effectively in irrigating green areas; for cleaning roads and besides tackling the huge flooding problem. From a financial perspective, 85% of the project will be financed by the EU structural funds, to be completed within 4-6 years period, (The Times, 2006b). This awareness of safeguarding water resources in the Maltese Islands has in the past been tackled thanks to water catchments and reservoirs which where being used to gather rain water. Although there was no serious flooding this year (2007) due to the lack of rainfall, rainwater saving not only reduces flooding drastically, but also leads to water resource protection and augmentation of supply.

Systems have been devised to show how a simple project in an average Maltese household, could save the country millions of Liri in water production and flood mitigation costs, (Cremona in The Times, 2006b). It has been stressed that Malta needs to put in place a national water saving strategy with simple, practical measures adopted at the domestic level. Through studies carried out using a prototype system installed in a home it was concluded that, by utilising rain water, a typical Maltese family of 3 to 4 people living in an average-sized house can save more than two-thirds of their water bills. This can be attained whenever the rain water which falls on the roof is systematically collected. This translates into water production costs going down by up to Lm8 million each year, if this system is adopted on nationwide basis. Rainwater can be conserved in a well or water tank on the roof, and serve all year around secondary uses, (The Times, 2006b).

Empirical evidence indicates (The Times, 2006b), that drinking water accounts for less than 2% of a household's typical consumption. Thus the water saving related to drinking water is minimal. A typical household would save 67% of its average water use (240 litres per household per day) with a 6.5 cubic metre well or tank and the standard one cubic metre roof tank. Lm72 can be saved per year and when calculated with the 55 surcharge, this presents 76% of savings in the water bill. These estimates were proven by means of taking into consideration the official rainfall figures for each month of four years, together with a calculation of the amount of water that fell each month on the roof of a typical house, (The Times 2006 b).

The project highlighted above entails a one-time cost of about Lm150 to install the water pump and its electrical control and a UV system which kills any bacteria that may be present in the water. With a 55% surcharge on water bills, costs would be recuperated within the first two-and-a-half years. This calculation takes into account the cost of electricity consumed by

the electric pump and UV system, together with the annual replacement of the UV lamp sum up to about Lm20 a year, (The Times, 2006b).

This process is ideal for houses which already have a well or a cistern, and those which do not have one can use a 6.5-cubic-metre tank, (The Times, 2006b). The only bottleneck would be for rented properties, flats or houses in high rise buildings, where ownership issues relating to the roof and basement prop up. Unfortunately most of the houses constructed within the last 30 years, do not have a well. The result is that rain falls on these properties resulting in flooding and overloading of the sewage network.

The method highlighted can be further refined. A system to collect waste water from showers and from the washing machine can be employed in flushing toilets after filtering it. This incorporates practical measures at a domestic level, with a simple water saving strategy so that these innovative methods are used in practise. These implementations reduce water bill costs and the moreover costs of the reverse osmosis water production.

2.8 Water within the Political Agenda

"Any nation concerned about the quality of life, now and forever, must be concerned about conservation. It will not be enough to merely halt the damage we've done."
George Bush, (S.M Haslam and J.Borg, 1998, Chapter 10, pg.164).

Lack of awareness on the part of the Maltese public indicates the long-term damage of groundwater depletion, in particular to the damage of the fragile boundary between the saline and freshwater layers. Professional and urgent measures are required to safeguard the country's future interests in this field before it is too late. A holistic professional approach ensures the regeneration of the groundwater. It minimizes damage by controlling storm

water runoff and protecting water quality. The latter can be controlled by community education, improved operations, maintenance practices and small storm water treatment measures on-site. Stakeholders get rid of the storm water runoff only for a short-term period, because by diverting it into the sea, the problem is not solved. This shows that since water issues are not on the political agenda, the problem remains unsolved, (Scicluna, 2004).

The Water Policy Framework Regulations (L.N 194 of 2004) is the legal notice that aims to manage water in a holistic manner, through the close involvement of the general public and stakeholders. This vital strategy ensures that water protection is expanded. Industrialisation, the steep rise in living standards and the demands by the agricultural sector has led to a steep rise in the demand for water. Thus, apart from adjusting supply with demand, there is the pressing need, favouring the usage of water particularly within domestic and commercial sectors, (www.mepa.org.mt). In view of Malta's accession within the EU, improvements have to be implemented in view of fines - let alone the need to adjust and adapt more effective systems, (The Times, 2006).

Article 8 of the Water Policy Framework Regulations establishes the requirements for the monitoring of surface water status, groundwater status and protected areas. Monitoring programmes and the protection of valuable sites such as water catchments and its water is vital and if not protected yet, they need to be safeguarded until such protection is given to them, (www.mepa.org.mt).

The investment in Storm Water Management must match the investment in road construction. Subsequently the government must invest within a team of professionals who adopt integrated approaches, so that a nationwide satisfactory result can be attained. Such teams incorporate hydrologists, water engineers, civil engineers, biologists, chemists, meteorologist and architects. The primary goal of urban storm water management plans is to

facilitate the coordinated management of storm water, within a catchment. The underlying objectives maximise ecological sustainability, thus reaping the social and economic benefits of healthy storm water management practices, (Scicluna, 2004).

Certain infrastructural road-works provide healthy incentives in future similar projects. Psaila Street was one of the first road-works designed to accommodate a storm water network discharging into a reservoir at the Birkirkara valley. It was designed to cater for the Santa Venera catchment area. The rebuilt Psaila Street is now almost three years old and to date no flooding problems or other related complaints have been registered. This project also relieved problems of flooding from the Birkirkara Valley. This 1.5km long road has been adequately furnished, complemented with a storm water pipe. The latter relieves this water from the valley. However, the problem has not yet been fully solved. This is one case indicating the need for a holistic approach, (Scicluna, 2004). Diversion of water from road surfaces in this respect can be adequately attained thanks to:

- The building of an adequate surface-water-runoff network, (Scicluna, 2004).
- The storing of surface runoff as possible by building reservoirs, ponds and dams, (Scicluna, 2004).
- The usage of roadside channels, (Scicluna, 2004).

This will eventually reduce damage to the road substructure and reduce the number of accidents, (Scicluna, 2004).

2.9 Possible Causes underpinning the Local Water Crisis

Malta faces a total demand water rate of 57million m^3/year. Water resources have always been considered of strategic importance. Water levels began to fall throughout the first half of the 20th century since aquifers were being over-drained by continuous overuse. Demographic pressures further escalated water problems, particularly in view of better

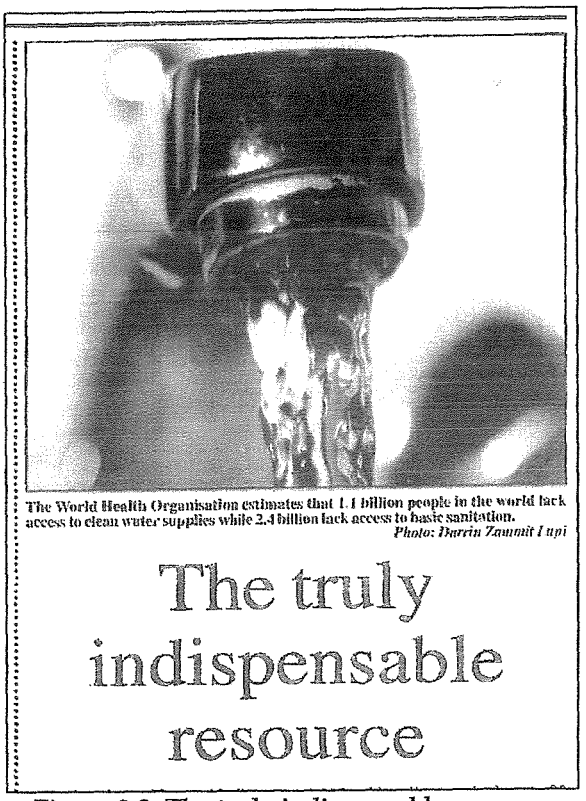
quality of life, and the demand for more household amenities. Foremost among these are washing machines and flushing systems, (FAO, 2006).

It is imperative to state that not only Malta's 'water environment', but also the surrounding ecology is vulnerable. Thus the use of resources need not conduce to abuse.

"Everything one sees in Malta, other than the major topographical features, is man-made and man-maintained in existence. For this reason there is an unstable equilibrium that eternally threatens to collapse." Unless effective planning controls and active conservation measures are taken by Government, more decay can be expected, (S.M. Haslam, pg.347, 1997).

In this respect both the life style patterns and aspirations of the Maltese changed rapidly. The need for rainwater harvesting and water conservation is deep rooted. Malta has always suffered from water shortages because of our semi-arid climate, (Gordon Knox – personal communication). Global warming is not an explanation for Malta's severe water crisis. The lack of water and climate change, have provoked a great awareness during the first two months of the year 2007. People are feeling the need to enhance change on diverse levels.

A major contributing factor to the lack of water resource management in the Maltese Islands is the long felt gap, in an approved Water Policy that would set a road map towards holistic water resource management through the integration of different stakeholders' roles and responsibilities. Various literature particularly newspapers' articles, are now exposing this long-felt need, (figure 2.2). The absence of an appropriate programme of unmonitored abstraction will resulted in the mean-sea level aquifer being further depleted due to salinisation. This means that a full reliance on RO generates more electricity and fuel, therefore a more expensive water bill. Gordon Knox (an expert on climate change and hydrology) questions whether this situation will encourage the government to take constructive action and the civic public to begin saving, storing and managing water effectively.



The World Health Organisation estimates that 1.1 billion people in the world lack access to clean water supplies while 2.4 billion lack access to basic sanitation.
Photo: Barrin Zammit Lupi

The truly indispensable resource

Figure 2.2: The truly indispensable resource
Source: The Times, December 14th, 2005

It is imperative at this stage, that prior to evaluating the causes underpinning the local water crisis, the climatic characteristics of the Maltese Archipelago need to be evaluated. The climate of the Maltese Islands is typically semi-arid Mediterranean, characterized by hot, dry summers and mild, wet winters. During the summer season, the islands are dominated by high-pressure conditions. The mean annual rainfall was about 550mm between the periods of 1900-2000. This is characterised by high seasonal and inter annual variability, with some years being excessively wet and alternative periods being extremely dry. The highest precipitation rates generally occur between October and February. Rainfall featured by storms of high intensity but of relatively short duration, (FAO, 2006).

According to the Meteorological Office of MIA, the month of January 2007, was the second driest January throughout the past 84 years. It registered only five rain days, and a mere total of 8.6mm recorded, just a fraction of the 95.5mm January average. The prospects of rainfall patterns are not optimal. According to the recent report by the IPCC (May, 2007), the

Mediterranean will experience a drop in average rainfall. In Malta, it is estimated that there will be at least 20% reduction in rainfall, leading to an acute water shortage in the long run, (www.ipcc.ch).

Annual rainfall by 2100 is expected to fall by 10-40% over much of Africa and southeast Spain, with smaller but significant changes in other places. The rainfall pattern is also expected to change, resulting in a shorter rainy season with shorter but higher-intensity storms, (FAO, 2006). On a per capita basis, Malta has the scarcest water supply of any country in the world and both drought and illegal extraction worsen the situation. This strategy must encourage us more to 'conserve' and 'treat' water adequately. Water is not on the political agenda. There is plenty that can be done by Maltese administrators. One needs to decide what particular constructive direction must be taken, (The Times, February 8, 2007).

2.10 Conclusion

To reduce this problem of water, Maltese strategies can effectively adopt a number of measures, foremost, the reduction in population levels, and the reduction in consumption; the reduction abstraction from the Mean sea level aquifer to sustainable levels; the trapping of rainwater run-off by means of wells and reservoirs construction and also through the planting of more trees. In this way, water demand management is being tackled and being socially sensitive for both present and future generations. Sever penalisation of water theft, and the encouragement of the recycling of waste water for both agriculture and domestic households, can act as water saving practices. Moreover education campaigns and policies across the board are basic and fundamental measures that are prerequisites for water conservation across all sectors, the domestic, agricultural and industrial.

Chapter 3

A Structured Approach towards assessing the potential of the public attitudes towards domestic water conservation at Zejtun and B'Kara

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3.1 The basis of the research framework

This chapter portrays the framework which formed the basis of the set of objectives outlined in Chapter 1. This Integrated Approach is based on the type of method adopted, the selection of this methodology, the collection of secondary data and interviews and finally its analysis. Information on how each technique was planned, designed and conducted will be given throughout this chapter.

The methodologies employed had significant implications on the findings and credibility of the study, and detailed sources of error have also been identified.

3.2 Data collection

Secondary data is information derived from published documentary sources. This data ranges from official statistics, historical and personal documents, books, research papers, newspapers, websites on the Internet and even films. Secondary data provides a great deal of important information, which is insightful to the research outcome. This type of data must be used with caution, and it is not always possible to know the criteria surrounding either the collection or the selection of the information.

Local newspapers and publications were mainly consulted to construct the data required. Local websites of national institutions and authorities, who are generally Water Data Managers on the island such as MEPA, MRA and WSC, together with local newspaper websites, were viewed for further information. The main pitfall with secondary data collected from these sources, particularly newspapers, is that the published data is not always reliable since they tend to be subjective.

Table 3.1 shows a structured table of how the data collected for this research has been incorporated, within each chapter.

Stages of this study	Processes
A. Aim/Objectives	1. To assess the degree of public awareness on water conservation in Zejtun and B'Kara
B. Literature Review: Water and its conservation: Local and International Cases	2. The water resources management from a local, regional and national perspective
C. Technique Application	3. The methods employed in the gathering primary and secondary sources of information
D. Evaluation of the 1st part of the interview	4. Socio-economic results' analysis & the water conservation consciousness of the Maltese public using basic statistical analysis
E. Analysis of the 2nd part of the interview	5. Water conservation attitudes of Zejtun and B'Kara participants and the political participation in this issue
F. Recommendations	6. Conclusions and recommendations for further research

Table 3.1: The Structural framework which formed the basis of the study

3.3 The collection of Primary Data

Primary data was compiled by means of the residential interviews carried out at Zejtun and B'Kara. These two localities were chosen because they enjoy varying characteristics and environments thus creating different situations. Rainfall in B'Kara causes flooding, while at Zejtun rainwater fails to accumulate to form flooding. The interview (Appendix III) is structured in 3 sections where the socio-economic data, the knowledge of the respondents on water, its conservation, its benefits, and the solutions of this management are assessed. A section focuses on the problem of flooding within both localities.

This section analyses whether the flooding problem results in the encouragement of the respondents to RWH or alternatively adopting conservation through water saving mechanisms. The former alleviates flood risk, which in turn could effectively minimize financial costs incurred at domestic and national levels. The amount of rainfall during the last year (2006) was considered. This enables comparisons to be carried out between the amounts of rainfall available in one year, with the number of people conserving water domestically. Due to the fact that the interviews were carried out in September of last year, only last year's rainfall was employed as an indicator of this comparison.

An interview is a widely used tool in data collection. The term is usually applied to formal, standardised questionnaires employed within large-scale social surveys. The format of the interview must be simple and practical so that the interviewees comprehend the questions and its objectives. Interviews help to standardize interviews, increasing the consistency of response, but cannot completely eliminate interviewer bias, (Marshall, 1998).

A good sample size and well representative one is considered crucial since they determine the validity of the primary data collected. Thus, the sample population had to reflect the

large population of both Zejtun and B'Kara. The larger the sample, the lower the chance of bias because one will have a lower probability to deviate from the assumed 'truth' or objective measurement, (Marshall, 1998).

3.4 The questionnaire design

Qualitative data is used because it is a type of data which expresses, information about feelings, values and attitudes, (Lawson and Garrod, 2000). Such data are usually associated with qualitative research methods such as participant observation, unstructured interviews and the use of certain kinds of personal documents. In fact, qualitative data result from open-ended questions/or semi-closed questions used in questionnaires. The interview was designed in a qualitative format, with few close and more open-ended questions.

The reasons for choosing open-ended questions over closed ones are several. Primarily, close questions are questions which allow the respondent only a specific range of answers such as Yes/No/Don't Know. In these types of questions, people have a fixed choice of answers to an interview question and they can choose the reply which is closest to their views or situation, (Marshall, 1998). Unlike, the close questions, the open-ended questions have no predetermined reply categories subsequently the respondents' reply must be written down by the interviewer, and coded after all interviews are completed, or grouped into broad categories of reply. This is time consuming.

What where the drawbacks of more open-ended questions?

Since these questions allow the respondent to reply freely rather than providing a set of answers from which to choose. This allows the collection of much useful and interesting information. It was identified, however, that open-ended questions pose a problem in their

analysis, particularly if a large amount of information has been gathered, (Lawson and Garrod, 2000).

A pilot-study test of the interview was carried out before starting the actual interviewing process. A total of ten people participated within this pilot study which was employed to test the utility of the research design, and the questions used in the interview. Only minor adjustment was carried out to the pilot study after it was tested. This helped one to feel more at ease with the questionnaire itself.

The B'Kara Local Council was contacted via e-mail, to have a clearer perspective which roads are more likely to be affected by flooding. The Local Council enabled further communication with the contract manager of the B'Kara Local Council, architects Mr. Joe Bugeja and Mr. Dathan Muscat from Joe Bugeja Associates. These personnel helped in compiling further information regarding the effects of flooding within the area. A list of the major six streets impacted by flooding at B'Kara was retrieved. As already highlighted, at Zejtun flooding is not a problem as at B'Kara. Nevertheless the Zejtun Local Council was also contacted in order to study the different attitudes or adaptations which the Local Council proposed. The six streets indicated by the B'Kara Local Council were not enough to obtain a sufficient representative sample in carrying out the interviews. Furthermore no list of roads was highlighted by the Zejtun Local Council. Systematic sampling had to be employed ensuring both random and representative results.

3.5 Response rate and sample representation

The fourth number was chosen randomly from a bag with numbers from one to ten. Every fourth street was chosen from the list. This method is more accurate since every street had an equal probability of selection. Bias is reduced, however the interviewer working on this type

of sampling, will have to exert great effort in persuading potential respondents to participate within this research.

Since all age groups had to be targeted and considered indispensable for the collection of information, interviews were carried out during mornings and afternoons, of the month of September, 2006. Face-to-face interviews were carried out and households were chosen randomly. Non-responding households were marked and a second attempt to consult the same household was carried out at another time of the day. Interviews were administered either in Maltese or English, in view of the willingness of the respondent. Originally, the selection of the participants was going to be carried out thanks to systematic sampling, that is, every alternate household. The main problem identified with this was that it was time consuming and not all age groups were targeted.

The sampling frame, which is the list of people from which a sample will be drawn, needs to be representative of the whole population. It is not easy to ensure that the sampling frame is complete and representative. According to the NSO statistics (2005) of each Local Council, Zejtun has a population of approximately 11,800 while there are about 23,000 people in B'Kara at the present day. So, a method which ensures that every individual within the sampling frame has an equal chance of being included in the sample was needed. A number of interviews in each town were chosen randomly since this was more likely free of any potential bias in comparison with alternative methods.

Several factors had to be considered such as time, cost and statistical limitations in order to determine the appropriate sample size. The latter is particularly important since ultimately the significance of the correlation coefficient in a statistical test is influenced by the population size (Rogerson, 2001). Whenever a population sample size (n) is chosen to be 100, the minimum absolute value of the correlation coefficient, are needed to attain a statistically

significant result using a confidence level of 95% (i.e. α=0.05), is 0.197, (Cardona, 2006). Based on the time constraints the sample size determined was 150 in Zejtun and 150 at Birkirkara. A 300 interview overall quite a representative sample.

The interview consisted of 20 questions, with a time allowance of 5 minutes each. The response rate was very high targeting 92%, and leaving just 35 people disinterested in participating. This was a very small percentage when compared with the sample. Moreover there were no problems for prospective respondent in co-operating. Some people who were busy at that moment, made an appointment so the interview could be held at another time of the day or on another day altogether. People seemed interested in this interview, because they shared their common experiences related to flooding, in view of the damages caused by this problem.

After every interview a water conservation brochure (Appendix IV) published by the WSC was distributed so as to make the public more aware concerning levels of consumption patters on a weekly basis. This consisting of filling a table with the amount of litres used and/or wasted every day by one person. This was then multiplied by the amount of water used per number of residents within the average household.

Five interviews were sent via e-mail to the Zejtun and B'Kara Local Councils, to Dr. Francis Aguis who deals with agriculture-related issues within the parliament. Moreover they were also sent to Mr. Mario Galea, a Zejtun resident who is the 'whip' of the parliament. However, only the latter participated in this interview, because there was no effective sign of response from the other participants.

The interview is segmented within three sections - Section A of the interview (refer to Appendix III) consists of the socio-economic data such as the gender, age and occupation of

the person being interviewed. This section is considered to be significant, since data gathered are an indicator of how well represented the study was in terms of various age groups, gender and occupation. This helped to decrease bias as much as possible. The occupation of an individual is an optimal indicator of the state of living of the person and/or family.

An assumption was designed on the basis that if one has a low wage, this can encourage the person/family to save water more in order to decrease the total outlay on water and vice versa. Approximately, an equal number from each age group, with a low distinct difference between males and females, was always taken into account, so that the sample will be as 'representative' as possible. The represented age groups are between; 13-20, 20-35, 35-45, 45-60 and 60+. The division of the occupations included:

- Self-employed
- Business entrepreneur
- Private sector employee
- Civil servant
- Student
- Housewife
- Retired
- Unemployed

Finally, the age and occupation related questions were targeted to all age groups and to all types of occupations.

Section B (refer to Appendix III) focused on whether there is enough public awareness on the value of water resources in people's home, and how 'valuable' water is to both human life and the county. This section consists of 13 close and open-ended questions. All close-ended

questions within this section raised a lot of data and gave a clearer view of the real scenario within both localities. The latter are backed by open-ended questions, stating a more detailed answer, with underlying reasons. This question served as an introduction to open the questionnaire. The interview probes in more depth by asking about the personal aspect of water conservation, together with the explanations of their personal thinking concerning perceptions and sensitive issues related to water. Another two closed-ended questions posed to the interviewee to state whether he/she knows that water is found in a very short supply in Malta, and whenever this crisis builds up, this will pose a problem for the whole country and for future generations.

One of the most important questions in the interview is when the people are asked for their way of preservation, saving and safeguarding of water within their household. Respondents who fail to preserve rainwater are questioned, to identify the underlying reasons and if further knowledge about water conservation solutions would help in safeguarding effectively water resources.

The last two questions of Section B positions in question the action done by the media and education. The respondents' express their hope regarding future improvements on water within the last question of this section.

This section includes a mixture of both open and close-ended questions in order to assess the problem of flooding. Thus the difference between the two localities emerges in a clear cut manner throughout the last four questions. Section C (refer to Appendix III) moreover stresses that the political will is vital for every strategic action undertaken within every territory/region of the Maltese Archipelago. The work of the Local Councils, if effectively executed, can diminish the flooding problem as need to be highlighted on a nation wide level.

3.6 A Concluding Evaluation

These three integrated sections analysed within one interview, probe diverse aspects. Foremost are the strategic factors of the socio-economy, the public attitudes of water conservation, environmental constraints, policy making and education. This whole analysis is discussed further within Chapters 4 and 5.

Chapter 4

The degree of influence posed by various social and socio-economic factors on Water Conservation in Zejtun and B'Kara

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4.1 Introduction

This chapter analysis whether water conservation is affected by social and socio-economic factors such as age, gender and occupation. Moreover it also evaluates the degree of consciousness the interviewees have regarding how valuable water is to their lives. The data of both localities are compared in assessing the hypothesis within this study.

4.2 Social and Socio-Economic Analysis: Gender, Age and Occupation

This section starts with an evaluation in checking whether socio-economic factors such as gender, age and the occupation of the respondent influences their respectful awareness regarding water conservation and the degree of water conservation in practice. These social and socio-economic factors are likely to influence the level of consciousness on water resources and conservation.

For instance, it can also be assumed that education influences the rate of water conservation within people's households due to the fact that education impact members of the civic public to be more sensitive regarding such critical issues.

4.2.1 Gender

Table 4.1 shows the close range in gender interviewed in both localities, which makes the sample more representative. Differences in gender, does not necessarily reflect any varying degrees of people's perceptions and awareness on water conservation in their homes. However, it is interesting to note that the difference could be that in the past males, the breadwinner of the family, used to pay the water bill.

However, according to the Maltese sociologist Abela (1991), within our contemporary society, things have changed. The structure of the family changed to individuals, single-mothers, and the improvements of women within the society and in the working sector. The latter have encouraged women to take care of the economic affairs of the family. Presently, both genders are fully conscious on the ever-increasing price of water. The person that pays the bill can act and raise consciousness on every family member who consume more water at home.

The gender does not have any effect on the mentality and practice on water conservation. However, the sex of a person can affect the stereotypes influenced by society. For example, men are usually in charge of the maintenance of water canals, water tanks and wells, while women just consume water, as shown in plates 4.1 and 4.2. According to the UN Water, 2006 in most societies, women have primary responsibility for management of household water supply, sanitation and health in view of their dependence on water resources. Subsequently, women have accumulated considerable knowledge about water resources, including location, quality and storage methods. However, efforts geared towards improving the

management of the world's finite water resources and extending access to safe drinking water and adequate sanitation, often overlook the central role of women regarding Water Management.

The International Decade for Action, 'Water for Life' (2005-2015), calls for women's participation and involvement in water-related development efforts, with the timeframe for meeting the Millennium Development Goals. The third goal emphasizes the close inter linkages between gender equality and women's empowerment. Many cases reveal that water projects work better when women are involved who enjoy a greater impact in mobilizing finance. The latter indicates that access to water has an impact on gender equality. According, to 'Water for life' the development of a network between gender and water reaches a sustainable management of water resources and sanitation which provides great benefits to both society and the economy as a whole. Thus, it is crucial, first, to involve both women and men in water resource management and sanitation.

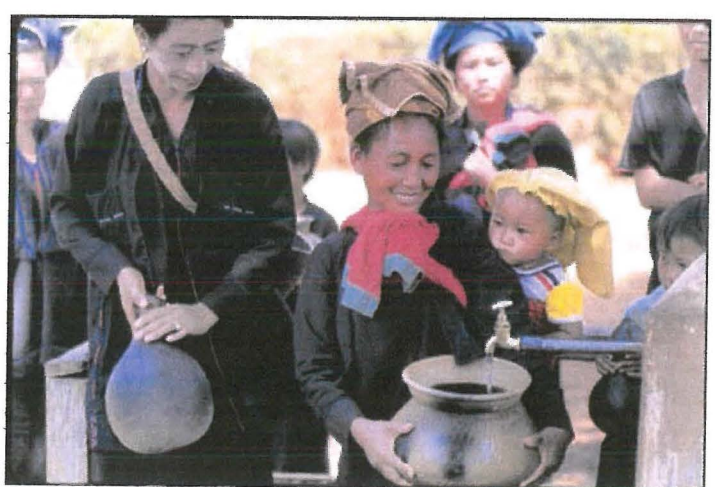

Plate 4.1: A woman with a baby on her back filling a clay pot with water in Myanmar
Source: UN – Water, 2006

Plate 4.2: Women carrying water vessels in Guatamela
Source: UN – Water, 2006

This article of 'Gender, Water and Sanitation', 2006 states that woman are under-represented in the 'water world'. Careers and training regarding water management are to a large measure dominated by men. The Watersheds and Gender project in El Salvador, is an example of how women learned innovative skills through participation and involvement. The project has promoted women as leaders, successfully training them as community promoters and managers of small scale companies. As a result, women have acquired technical agricultural knowledge, and are now performing tasks previously considered suitable only for men.

Gender:	Zejtun	B'Kara
Males	47%	45%
Females	53%	55%

Table 4.1: The gender of Zejtun and B'Kara participants carried out in the interviews

4.2.2 Age and Occupation

Age has been found to be a factor in influencing different views and even practices in domestic water conservation. This could be due to a number of complementary factors associated with age such as educational backing, or environmental awareness, which has become so prominent in the last twenty years. In a study carried out by Cranfield University

(UK), it has been proven, that age and the propensity to conduct water conservation in the Nene catchment, Lincolnshire, were positively correlated, (http://www.environment-agency.gov.uk/subjects/waterres/bulletins/).

A slight difference between the 5 interviewed age groups with different range of opinions by generations is indicated in table 4.2. The majority of participants have between 45 and 60 at B'Kara. However, this mainstream does not outline that this age group is more concerned on water conservation, since all respondents reacted differently along the interviews. Most of the participant teenagers between the age of 13 and 19 are fully aware that water is an important asset to every living thing in the world, but they have a fun relationship with water. They tend to use it in their recreational time, playing water games.

Age:	Zejtun	B'Kara
13-25	19%	16%
25-35	21%	19%
35-45	19%	14%
45-60	21%	30%
60+	20%	21%

Table 4.2: Range of age occurrences for both localities respondents

Many stated that the schools, in children programmes and in reading books, do not emphasize to a sufficient degree, water consumption and its management. They highlighted that *"Water is important to our life and we need to take care of it."* Nevertheless, not enough information was given on how one should conserve or manage it. Half of the respondents having between 20 and 35 are fully aware that water is vital, and that a number of places in the world suffer from water crisis. Whenever this typical situation accumulates, Malta will soon shift in this critical state. Likewise steps of conservation are taken to diminish this problem, in order that everyone benefits. Others do not know how water conservation is achieved effectively. However, on the other hand 40s, 50s and above 60 year old interviewees

are the more likely to take action, because they know that water is a very limited resource. Thus the collection of rainwater in people's houses is truly needed.

Moreover, people between 50 and 60+, who tend to enjoy higher levels of education, also tend to be more aware regarding water conservation. They emphasized that the public should be thoroughly educated regarding water conservation issues. The reason for the sensitivity of this particular age group may be due to media hype and government propaganda which focused more, on this topic than recent years. It is insightful to indicate that the level of awareness regarding the water crisis is more present in the mind-frame of the younger generations. However people aged 45 years and over, are more conscious about water conservation and its applicability.

Occupation gives people a certain power in the hierarchal division and it reflects the level of education of a person. The research had the objective to interview all respondents so that bias is avoided and all working sectors are targeted. The education and the type of job can have a direct impact regarding the practice of water conservation. The more one is informed on this subject; a more responsible attitude is expected. However, this does not imply that literate persons recognize water conservation more than the illiterate counterpart. Education must not be assessed primarily in term of literacy, but also in view of one's practicality and outlook towards life in general. Different people have diverse levels of motivation in adjusting to change whenever necessary.

Table 4.3 demonstrates that 45% (67) housewives in Zejtun and 48% (72) in B'Kara, act as the majority of the participants in the interviews. This is because the percentage of working women in the Maltese Islands is the lowest level within the EU countries, being 32.6% according to a recent labour force survey, (http://aei.pitt.edu). This high participation of housewives identified a high rainwater usage in both localities if it is being harvested.

However, this does not mean that they take action to harvest it, because normally, men take care of water tanks, wells and pumps. The fact that housewives spend much more time at home does not illustrate that they consume or waste much water than the rest of the family. Some stated that some generally give lessons to their children that water must be used with limits. The contrary can be revealed since the contrary of the housewives consume water with care. This can be explained due to them using it for cooking, gardening and washing.

Occupations:	**Zejtun**	**Birkirkara**
Self-employed	4%	2%
Business entrepreneur	3%	5%
Private sector employee	5%	4%
Civil servant	9%	9%
Student	15%	14%
Housewife	45%	48%
Unemployed	1%	3%
Retired	18%	15%

Table 4.3: The occupational representations of the participants in Zejtun and B'Kara

Since Malta is becoming an ageing population 18% (27) and 15% (23) of the whole 'population' interviewed are pensioners. Most of them worked within the Primary Industry where water is the key asset within this sector. They are fully aware how it must be consumed and conserved, even if they lack schooling. Those who remembered the period of British Colonial Rule are knowledgeable of the particular attention by the past administrators, introducing laws within the Maltese legislation. However, this interest is diminishing over time. This age group includes respondents that give a major significance to rainwater harvesting and its benefits. Time improves technology and leads to mental openness. However it is evident, that past idioms composed and well-known by elder people, still persistent, such as *Kull qatra tghodd* (every drop counts) and *Bil-qatra l-qatra tintela l-garra* (every single drop fills the water-pot). This constantly changing world does not

change these 'facts of nature'. Practical education is indeed the most crucial for enhancing water conservation. The media can indeed play a highly critical role in this respect.

4.3 The level of public awareness regarding Water Conservation

A system which raises the level of public awareness on water conservation is a project of the MWGWR in the Middle East Peace process. The latter, sine its inception in 1992 implemented a variety of projects, to encourage public awareness on water conservation. This project consists in offering technical and financial support to its delegations, showing water videos to youths thus highlighting the importance of water issues. A publication, 'Water Care' is granted to every teacher to focus on water conservation issues in classes. The latter is complimented by offering a 'rain catcher' (water reservoir), pilot project which brings together government representatives, school administrators, teachers and students to instruct them on methods and the value of rain harvesting. This is presently being implemented in Israeli, Jordanian and Palestinian communities, (http://www.watercare.org/).

Table 4.4 explains the degree of water awareness in Malta. There is a marked high awareness at B'Kara by 98 respondents that make up 56% while 44% (78) according to the Zejtun respondents. On the other hand indicates that 56% or 72 participants from Zejtun think that there is no water sensitivity in Malta.

Water awareness in Malta	Zejtun	B'Kara
Yes	44%	56%
No	56%	43%
Don't Know	0%	1%

Table 4.4: Total interviewees responses from both localities

Since this question is very vague, it was subject to the respondent's interpretation. For instance by water awareness in Malta, one could link awareness related to the rate of water consumption, water conservation, politics, promotions, flooding, surface run-off and the depletion of ground water. Teenagers, youths and the 30 year olds are in the majority that stated that the Maltese are not knowledgeable in using water carefully and there is the prevailing attitude that, *"I don't care about water resources."* this was exposed in an explicit manner by a 22-year old student. One cannot make a general statement that elder people waste more water than the younger counterparts, or vice versa because this is all affected by the individual mentality and personal thinking. Some respondents perceive, water as an infinite resource, but some respondents think that this resource that once was thought to be ever-ending is now wasted carelessly. Respondents stated that in Malta a lot of water is wasted without care, by using water indiscriminately especially when washing floor, plates and toilets.

"This situation aggravates because water is wasted without any management and conservation measures, and the most important thing is that when water is needed we have it by just opening the taps and that's all!"

Certain individuals realized that since Malta is a small island without any lakes, rivers or mountains, more concern must be taken by someone today before tomorrow on this water issue.

Others stated that people do not worry about the present and future consequences and the volume of water being consumed daily per capita. This is due since many people put the washing machine pipe in the toilet instead of harvesting it in tanks to use it for further purposes such as flushing. Malta can lack financial resources, but a notice by the government encouraging simple, yet effective actions is not expensive.

William Marks (2002) stated that *"Polluting our planet's water is the same as poisoning the blood in our bodies."* Thus everyone must help in challenging the preservation of safe water and every individual must be actively participate in stating, *"I can help do this, I will try to do something in the interest of water each day."* Marks adds that, *"In time, people will discover that forming a conscious connection with water, will open them to a deeper understanding of themselves and the world through which water flows,"* (Carfagna 2003).

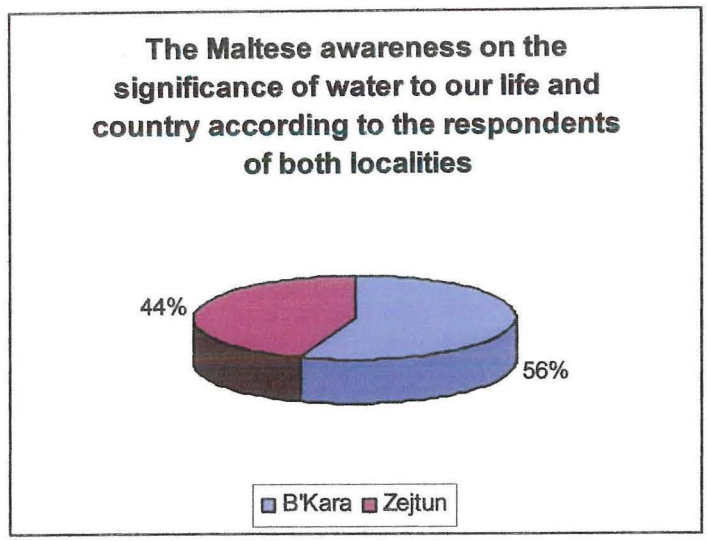

Figure 4.1: The consciousness of the Maltese on the worth of water as a resource

In 2001, the ADB outlined a vision for 'integrated water management' in the region, thanks to its "Water for All" policy. This policy recognizes the Asia and Pacific Region's need in formulating and implementing integrated, cross-sectional approaches to water management and development with the help of the public awareness. Since water is a socially vital economic good, it needs careful management on a long term basis. In this respect a participatory approach will help conserve and protect water resources ADB is promoting public awareness and education to help achieve sustainable water resources management and ultimately ensure optimal water services,

(http://www.adb.org/Water/Policy/default.asp).

The majority of the 56% perceive it as logical and state that since water is part of every individual's life, and without water all forms of life cease, the Maltese public is fully conscious about water resources and its costs. 59% (176) respondents out of the 300 (100%) interviewed are of the opinion that the Maltese need water to satisfy everyday needs. It is fundamental for drinking, washing, cooking and living. Due to this reality in Malta, people are prudent, and pay substantial attention on the consumption and types of utilities water is addressed.

The facts that the statistics in figure 4.1 indicates that at B'Kara respondents think that the Maltese public in general is more aware of the importance of water. 72% which accounts for 108 persons (shown in figure 4.3) are personally conscious about water resources and conservation while figure 4.2 shows that in Zejtun 66% (99) of the respondents are sensitive on this aspect. The awareness on the protection of water resources and RWH is ever-growing because there is an increase need of water in homes, industries, agriculture and businesses. A respondent stated that this entire situation is encouraging the individual to pay more attention regarding water usage, even on an agricultural level.

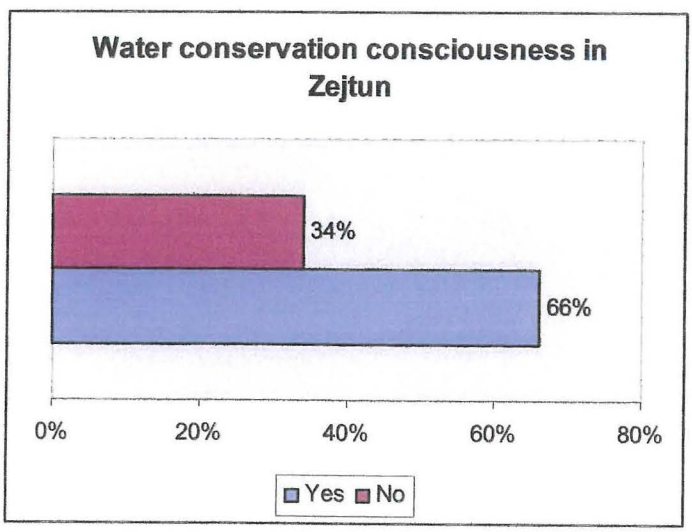

Figure 4.2: Participants' personal awareness on water resources and conservation in Zejtun

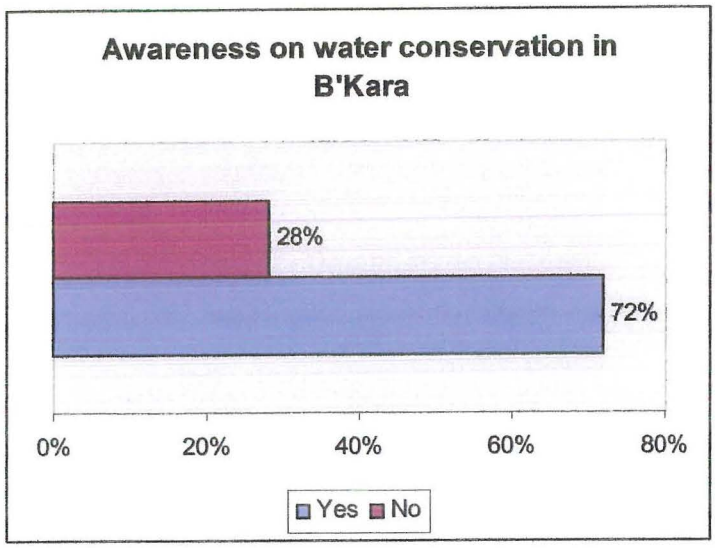

Figure 4.3: Participants' personal awareness on water resources and conservation in B'Kara

This question can create bias, because when direct questions are asked they make respondents react due to the structure of the question, in this case to the issues regarding water conservation. Some respondents though feel that they are being submitted to a personal test, thus, need to answer appropriately. Flooding encourages people to harvest rainwater on a higher scale because larger amounts of water are seen in B'Kara so they can pay more attention to water usage and RWH. Water consciousness results from water conservation in households and from RWH in wells, water tanks, and buckets and from strategies of reuse and reduction of water. This increases because *"when the well is dry, we know the worth of water,"* according to Benjamin Flanklin in Carfagna, 2003. Recycling of water is common between the Zejtun farmers where they use Sant'Antin Wastewater Treatment Plant to irrigate their plants.

The forthcoming chapter will address diverse issues chiefly - the benefits of conservation, the limitations that is limiting people to manage water and the impacts of the media and the political factors play.

Chapter 5

Political Participation and Governance in Water Conservation Campaigns

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5.1 Introduction: Water Conservation Implementation

Domestic water conservation depends upon the individual's will for water management, depending on a series of factors. This depends entirely on governance, and the role of politics, concerning water issues. Politics is a process of decision-making, capable to change history with power and authority, in order to improve local water conservation, whilst governance is that part of leadership process that makes decisions that define expectations, grant power, or verify performance. Frequently a government is established to administer these processes and systems.

5.2 Awareness regarding Water Conservation: Illustration of Factors

Despite the fact of the high level of water consciousness in both localities as shown in figures 4.2 and 4.3, it is not perceived that domestic water conservation is implemented.

Alternatively, the low degree of sensitivity towards water resources does not illustrate that none from the 34% respondents of Zejtun and 28% of B'Kara (table 5.1) do not safeguard water resources. The participants' levels of awareness do not show impact on the water protection rate.

Personal water awareness:	**Zejtun**	**B'Kara**
Yes	66%	72%
No	34%	28%

Table 5.1: The level of awareness of each respondent regarding water resources

138% of participants of both localities claimed that water is a multi-purpose resource. Its daily frequent use through drinking, eating, cooking, washing, heating, cooling and for irrigation make this resource an asset nobody can live without. Reducing water wastage and consumption levels diminishes the financial cost, which has the potential of getting more expensive due to increase outlay in RO production. This is shown in the kids' educational book 'Take Care of Water' taken the WSC website shown in Appendix V.

"*Destroying and diminishing water resources will impact all Maltese citizens,*" no matter one's hierarchal position, respondents continued to declare. 16% of the 'whole population' argued that the Maltese Archipelago is deficient in natural resources such as mountains and lakes. Moreover, this calls for further water management and protection. Thus the substantial amount of energy used by the RO to desalinate water should be lessened, but it is not.

The gathering of rainwater is not an easy task, since flooding accumulates only after a 15-minute time-span of heavy rainfall. This was thoroughly stated by 35% of the 138%, which also have the perception that water conservation is valuable in diminishing RO energy. RWH provides a good substitute of water for secondary class purposes.

Regardless of the meetings, conferences and reviews on 'sustainable development' held around Europe, only a 19 year-old student pointed out that this asset must be utilized in a sustainable manner with managed usage. 10% of the participants out of the 300 compared their degree of water consciousness together with the level of conservation adaptation. A various number of interviewees confessed that water conservation unconsciousness results from, the lack of knowledge on simple means or ways to conserve water together with the lack of space for a well/water tanks in their household.

"Water wastage is immoral and unethical for the whole society. Fresh water is fully appreciated, when present in a well," a participant stated. In this regard, if considering this statement from an environmental perspective, the fundamental aspect results in water safeguarding, rather than the economic aspect.

5.3 Water Scarcity in Malta: Fiction or Fact?

Table 5.1 indicates the high level of water consciousness amongst the 300 participants. This fact is also depicted in figures 5.1 and 5.2, revealing that 68% of Zejtun residents and 64% (96) of B'Kara interviewees believe that water resources are scarce within the Maltese Islands. This scarcity is getting more evident with time, resulting as a major detriment for the whole country, according to the majority of both localities respondents'.

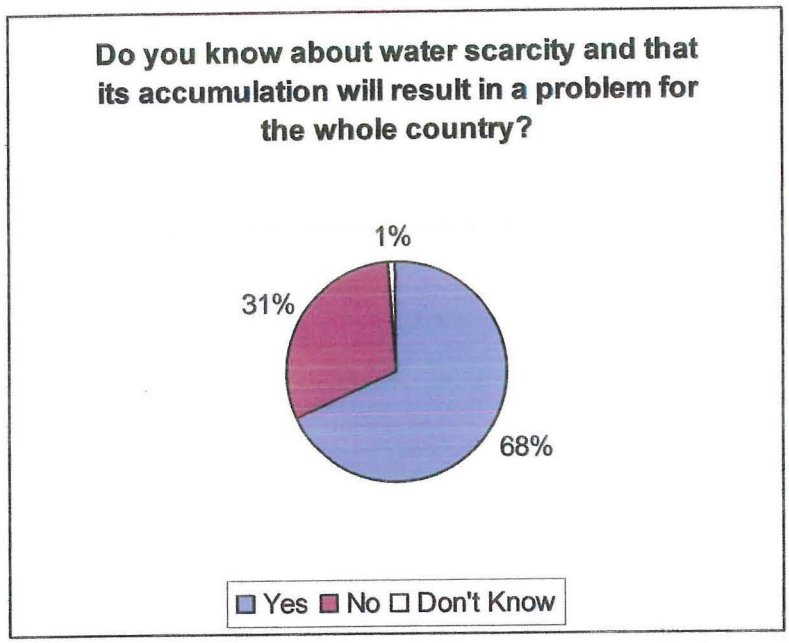


Figure 5.1: The majority of Zejtun respondents think that water scarcity is a national problem

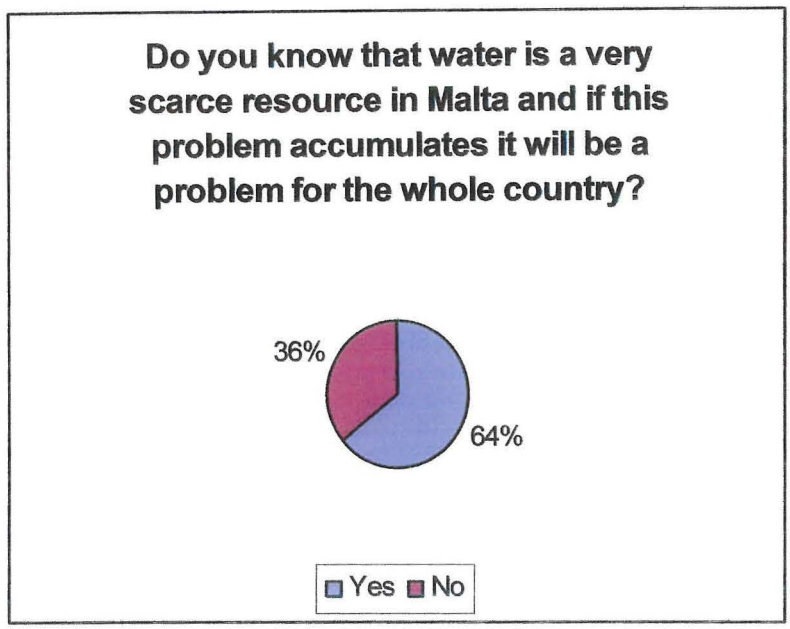


Figure 5.2: This figure illustrates the respondent's awareness regarding water scarcity together with this problem accumulation

Seattle, Washington suffered from scarcity reflecting the steady population growth together with the dry summers and the lack of long-term storage capacity. This forced Seattle to choose, either between water reduction or further development of alternative water sources. To tackle this problem, Seattle included water conservation programmes of plumbing fixture codes, leak reductions, incentives for water saving-products, public education and a special emphasize to community water conservation strategies. A drop of 20% in the water

consumption per capita, in the 1990s resulted from these programmes. This means, that improvements were credited with success. It was estimated that the commercial water conservation programmes saved approximately 8mgd, (EPA, 2002).

72% of the B'Kara respondents (table 5.1) are water conservation aware, but figure 5.2 verifies that fewer B'Kara respondents recognize water scarcity. Alternatively, at Zejtun the outcome was that 2% more, are familiar to this scarce asset. 31% from the 68% of Zejtun participants declared that the illegal increase in the digging of boreholes is further amplifying groundwater depletion. From this percentage 6% asserted that water dissipation is amplified due to the lack of wells in all type of household structures. Furthermore it was expressed that un-enforced laws also leads to water scarcity.

In B'Kara, 13% out of the 36% participants elicited that this state of water crisis is impacted by Malta's ever-increasing population density and growth (0.413%), according to the CIA Fact Book (2007). These factors are making additional pressure, to water resources. They stated that if this non-responsible growth continuous, scarcity increases so action for improvement must be instantaneously implemented. This lack of responsibility was also identified as being due to the absence of water in the political agenda. They also note that there is still no NGO specifically responsible on water environment issues.

Low rainfall exacerbates water shortage, and respondents pointed out that *"frequent water cuts are still present,"* showing a clear evidence of this scarcity. In contrast 3% out of the 64% B'Kara interviewees believed that, water cuts are now history. Modern technology of water desalination and the piping system and infrastructure arrangements no longer tolerate such inconveniences. *"When water is needed it is always present in our tap, regardless of, population growth and climate change,"* alleged a B'Kara respondent. This can either show indiscriminate use of water resources or lack of awareness, from the public due to the lack of information,

(https://www.cia.gov/cia/publications/factbook/geos/mt.html).

5.4 Domestic Water Conservation in Zejtun and B'Kara households

Percentages demonstrated in figures 5.3 and 5.4 display the high rate of conservation within both studied localities. Despite this high level of water conservation percentages of B'Kara (53% - 79) and those of Zejtun (54% - 81) measure a lower quantity of water resources awareness.

It was expected that the difference between both localities conservation, would be much higher than 1%. Due to the flood problem in B'Kara, results were anticipated that this would encourage residents in this locality to conserve water and implement RWH in their homes.

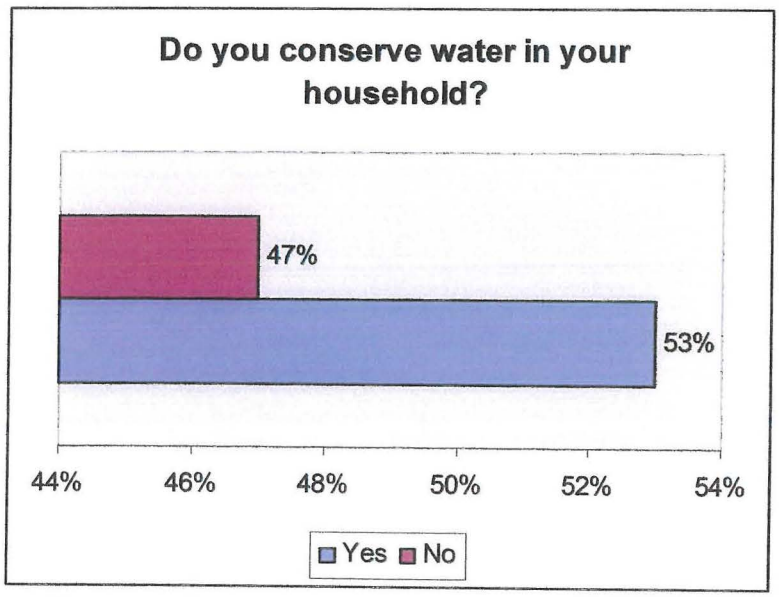


Figure 5.3: Water conservation among B'Kara participants

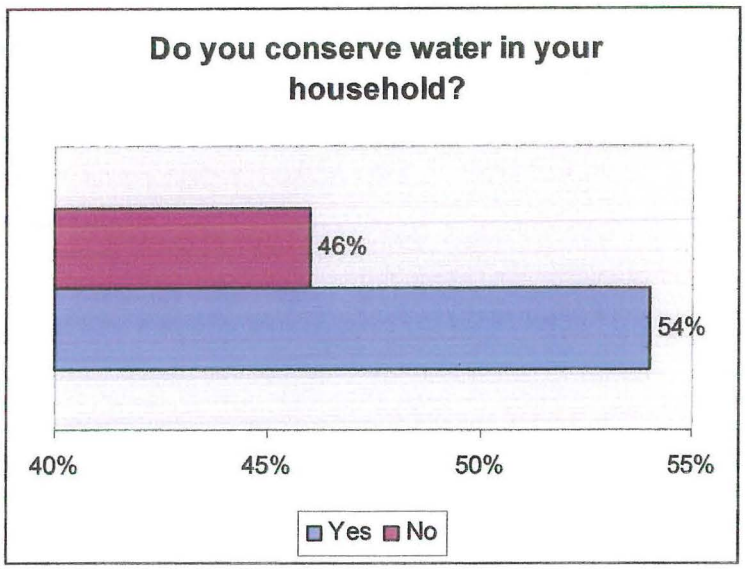


Figure 5.4: Water conservation among Zejtun participants

A clearer portrayal of a more comprehensible view of sustainability is given in this question. This proves that people's consciousness does not effect of water conservation practising.

An extensive number of participants are aware of water resources (table 5.1), while a very low degree (figures 5.3 and 5.4) follow the concept of 'sustainable development' in domestic water conservation. Reasons for conservation implementation are discussed in the next section.

5.4.1 The Implementation of Domestic Water Conservation

Around 99% of the residents employing water conservation declared that domestic consumption leads to the development of a healthier environment. Figure 5.5 shows that 51% (62) of Zejtun households (out of 81 respondents) utilize the well for conserving. On the other hand, in B'Kara 59 households (49%) out of the 79, make use of a well. These statistics are proven in figures 5.3 and 5.4.

Those utilizing a well stated that RWH is indispensable for irrigation, washing, cooking and drinking. In 5% (out of the 49%) of the B'Kara households RWH is fully implemented,

because they use two wells, with one participant using also a water tank for the collection of the over-flown rainwater.

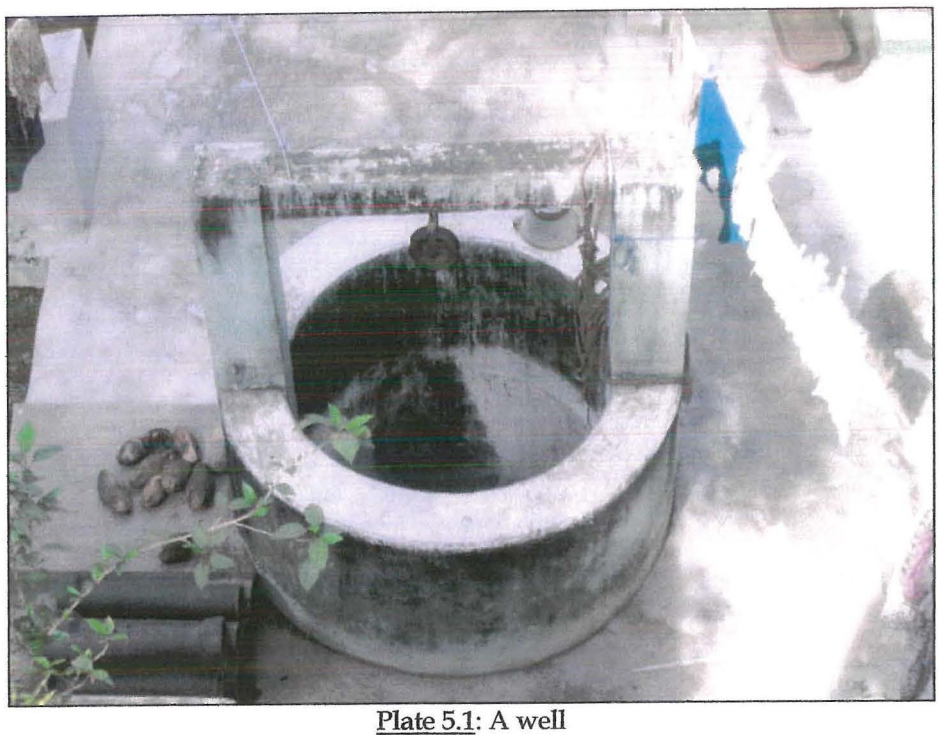


Plate 5.1: A well

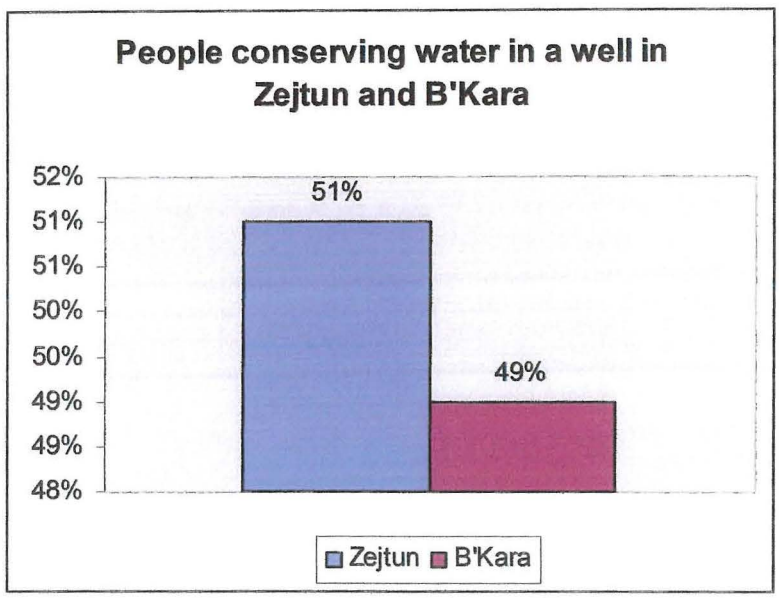


Figure 5.5: The number of wells in the 300 households of Zejtun and B'Kara

The space constraint is a factor that restricts certain households from constructing a well. 3% among the B'Kara participants wish to own a well. As a substitute, participants stated that buckets are filled from balconies or roofs or roads. Water collected from these catchments is

further used for flushing and washing purposes. This practise is more commonly employed in B'Kara having more surface run-off accumulating in roads.

11% in Zejtun and 13% in B'Kara use water tanks in their roofs or gardens or balconies in order to practise water management systems. This is in contrast with Zejtun where none of the respondents collect surface run-off. About 6% in Zejtun and 1% in B'Kara said that water management is employed by closing tap water. Reusing washing machine water in order to utilize it for further purposes, to make every drop count, (figure 5.6).


How to make every drop count

Figure 5.6: A newspaper cutting showing that every drop is worth
Source: The Times, 2006

It is assumed that having a shower instead of a bath consumes less water. A 55-year old woman in Zejtun confessed her way of conservation, that from a young age, her parents taught her that water can be collected in a basin, when having a shower. *"The well is not the only means of water conservation,"* the woman continued to state. Explanations of rainwater consumption is discussed in Section 5.4.2

5.4.2 The Reasons for Rainwater Utilisation

"Water conservation implementation, reduces the total water usage by 30% per year – a decrease of 75 gallons per capita/per day, over 9 years." This quotation is part of the Long-Range Water Conservation Strategy resolution, adopted in Albuquerque, New Mexico. The five components implemented are:

1. Water rates
2. Public Education

3. Residential use
4. Landscaping water use
5. Outdoor water use

(www.cabq.gov/waterconservation/index.html).

Both localities participants' that conserve water believe that since water is getting more expensive over time, its low consumption will further reduce economic and energy loss. Respondents' believed in the principle that rainwater utilisation is fresher, healthier, safer, tastier, cleaner, purer and better than tap water since it contains less salt. Section 5.4.3 discusses the environmental and financial benefits by less utilization of this 'strategic resource'.

5.4.3 *Water Management: Its gains*

Water-efficiency measures can reduce the economic outlay by buying less water from a water wholesaler, reducing water purchases and environmental costs for present and future generations. The financial benefits enhance the socio-economic benefits, including water conservation programs that cause water demand patterns to shift from higher to lower consumption. Saving water also saves energy. This has been best illustrated in the Californian state where 6.5% of the energy is used for pumping and treating water. For this reduction, a number of Californians were given a number of tips to reduce the energy and water bill. This alternative energy utilization saves water and electricity production from fossil fuels and from nuclear energy, a source of energy that is responsible for 39% of all freshwater withdrawals in the nation, (http://www.monolake.org/socalwater/wctips.htm).

A clear case in point of water management benefits is in Ontario (Barrie). By replacing inefficient showerheads and toilets this region saved:

- An average of 55 litres per capita/per day
- A 17.1 million Canadian Dollars in net capital expenditure
- An expensive infrastructural development
- New supply options, (EPA, 2002).

Water and financial saving are a vicious circle, affecting one another depending on the individuals' utilization. Water demand, has a pronounced environmental impact that depletes groundwater aquifers, (Pennsylvania Deparment of Environmental Protection).

Domestic water consumption in Malta is 70litres/per capita excluding losses in the distribution network. This is a low figure, when compared to other countries according to FAO, 2006. Thus, this does not implement that water conservation is not required, but per capita use reduction decreases generated wastewater.

The most cost-effective alternative is conservation rather than new water sources development. 'Prevention is better than Cure', therefore water conservation as immediate implimentation is indispensable.

5.5 Evaluating the causes regarding lack of Water Conservation

The lack of employing water conservation depends on several constraints, including space, finance and individual's mentality. Water conservation is not being employed among 46% of participants in Zejtun (figure 5.4 – section 5.4). This is because participants here own a well. The wrong perception that water conservation is only linked with the well is evident in this figure. This idea can result from the shortage of data provided, which is thus leading to a sufficient need of knowledge. Evidence of the B'Kara respondents, for not utilising rainwater is demonstrated in table 5.2.

Reasons for not utilising rainwater in B'Kara:	Total percentage of non-utilisation of rainwater: 47%
No need for utilising rainwater	6%
No space for a well	11%
Buried well	3%
Lack of maintenance of the well	4%
Small road canals	12%
Canals full of road waste	10%
Lack of water catchment areas	1%

Table 5.2: The basis of not employing rainwater

Water harvesting in B'Kara was interpreted both as the domestic RWH and as the gathering of surface run-off in local reservoirs. 12% advocated that the canals are too small when compared with the surface-runoff frequency (plate 5.2, 5.3 and 5.4). Consequently, local water conservation is employed but not sufficiently. Furthermore, it was stated that the canal dimension is neither reducing nor eliminating flooding. Moreover, when canals overflow, water rises drastically, causing more damage.

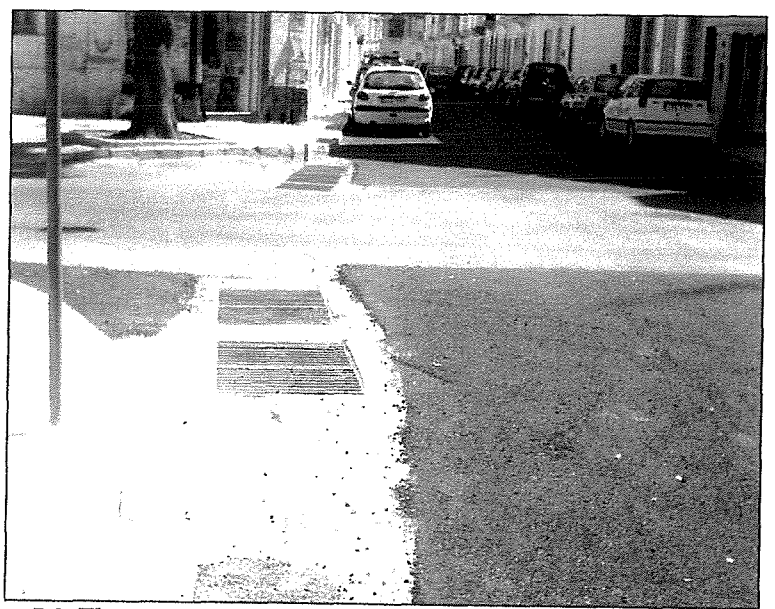
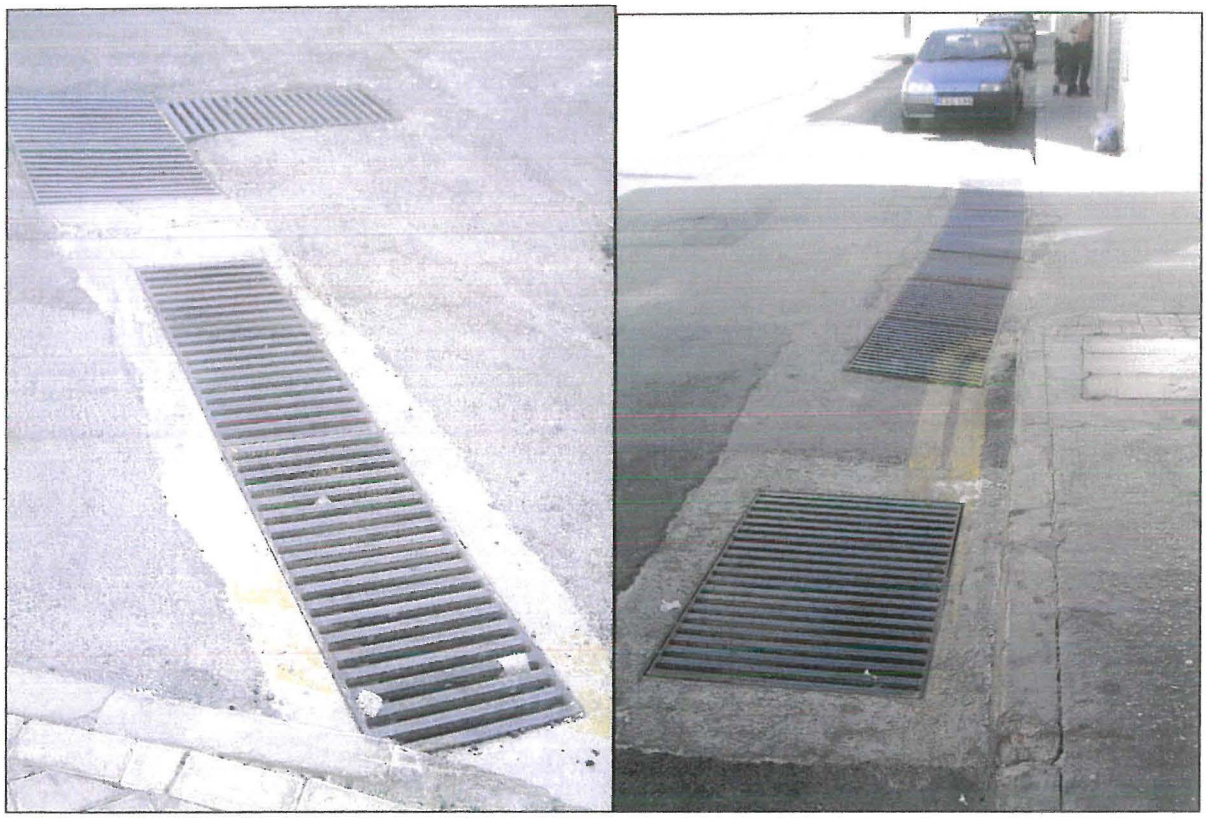


Plate 5.2: The size of the street in comparison with the canal's smallness



Plates 5.3 and 5.4: Canals made by the B'Kara Local Council for rainwater conservation

Plates 5.5 and 5.6 demonstrate what 10% of the B'Kara respondents declared (table 5.2). The road tubes are not cleaned occasionally, thus, they argued that these canals are being used for the collection of road dirtiness and wastes, eliminating their worth for the gathering of rainwater.

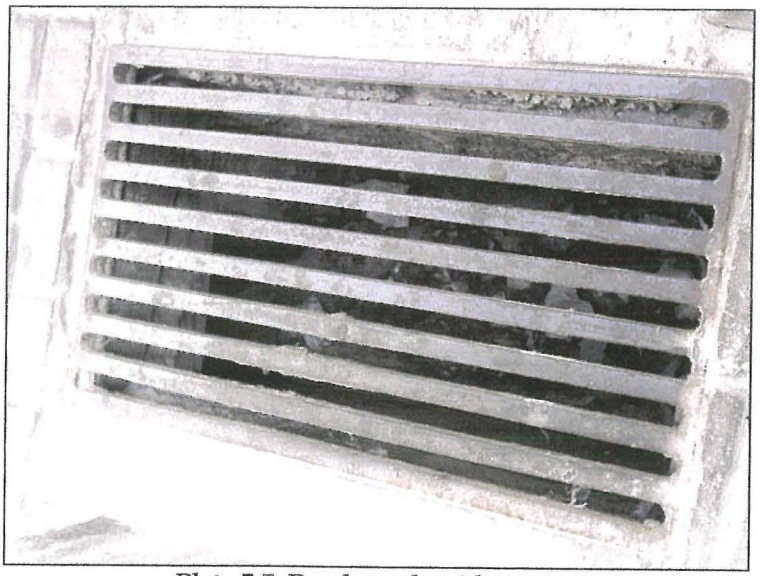


Plate 5.5: Road canals with wastes

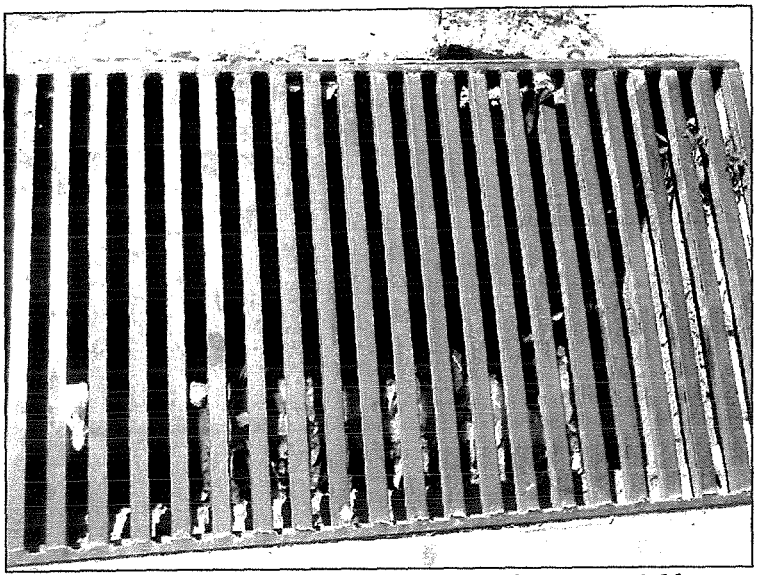


Plate 5.6: The canals waste reducing its size and its potential harvesting

Implementation of frequent cleaning is fundamental for the reduction of road-material obstructed, according to the respondents. A pensioner claimed that surface run-off gathering can be held in the Anglu Mallia Street shelter, if cleaned. *"This shelter, as in the past, can serve as a water catchment area, which is very-much needed to collect some of the flooding. This can be used for B'Kara purposes,"* he said.

23% out of the 47% said this reason of not utilising rainwater is due to the lack of road construction planning and maintenance. According to them, this lack of effective action for eliminating flooding is further creating pressure to residents.

6% (table 5.2) do not have any desire to conserve water. An interviewee claimed, *"I don't need to utilise rainwater because when I need it, I have it!"* This can either result from the lack of knowledge on the benefits that can be reaped from water conservation benefits or due to carelessness priorities.

The remaining 18%, that either do not have a buried or an un-cleaned well, declared their opinion that, if persuaded with incentives, they are fully able to take conservation responsibility. The lack of encouragement and politicians' action including media and education, are discussed in section 5.5.1.

5.5.1 Lack of awareness regarding domestic Water Conservation: Explanations

92% of the respondents' not preserving water in both localities stated that, not having enough room for a well restrict them for this conservation. 8% of the participants', lack water conservation education, not having any idea about this issue. To reach a water holistic approach, the government of Jayalalithaa Jayaram, made RWH as a mandatory for all existing and new buildings. With stubborn measures and people's cooperation most of the houses incorporated RWH structures. Ideas can be taken from foreign case studies, in order to implement this success of RWH to the Maltese Archipelago, (http://en.wikipedia.org/wiki/Jayalalithaa_Jayaram#Solution_to_water_scarcity).

5.6 Motivations in the safeguarding of water: are solutions an aid?

There was a fully agreement, between both localities participants'. Everyone consented that solutions will facilitate the concern on water conservation. This is indicated in figure 5.7.

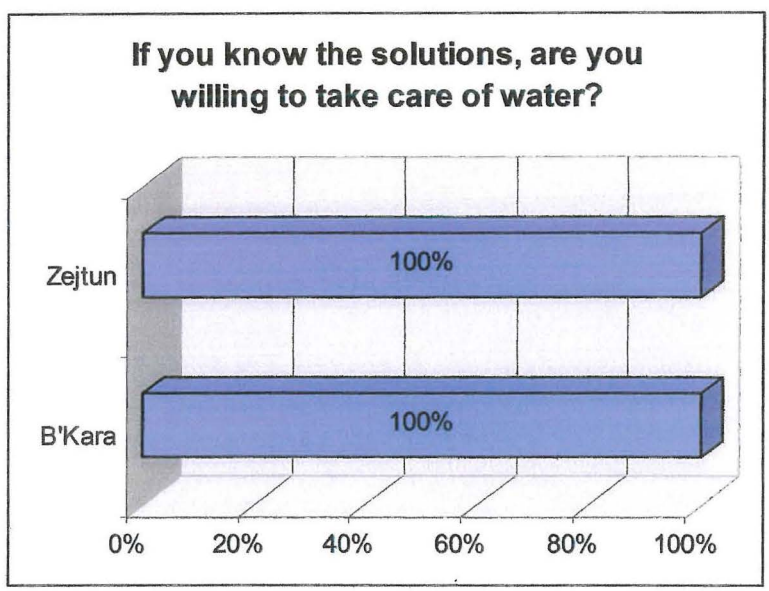


Figure 5.7: The will for improvements, with the help of solutions

This consensus illustrates, the ever increasing awareness that water resources exist in limited quantities. This water availability according to the respondents varies considerably, during

time and place. The heeding of water resources must become an indispensable part of every human being's life. Moreover, the much-needed knowledge and education on water conservation measures will results in benefits.

130% of the 'whole population' stated that realistic, practical and simple solutions are the key for improvement. Encouragement for learning will not result in a difficult task, since "where's a will, there's a way."
Everyone confirmed their utmost participation in order to ensure a good use of this scarce asset.

Leaflets are rarely posted in dwellings, but in 2006 a leaflet published by WSC, together with the water bill was posted. It was entitled, *Tahlix ilma* meaning 'Don't waste water', consisted of water saving tips on water conservation. This leaflet shown in Appendix VI is an ideal way of learning solutions, encouraging those receiving a fine bill, in diminishing this amount.

5.7 The Media and Education Roles, in enhancing Water Conservation

The media and education can be seen as two community leaders, constantly affecting this dynamic social mentality. The Commonwealth feels that water conservation or wise use of water should be practiced at all times. Thus, this performance must be encouraged further by the media and education.

Albuquerque (New Mexico) defines water public education, as programs consisting of:

- Running public relations campaigns
- Water usage information in water bills
- Organization of cooperative schools and community

- Public participation and consultation on new legislations/measures developed or proposed (www.cabq.gov/waterconservation/index.html).

The media, such as the World Wide Web, offers water conservation education for every age group, such as the site of,

(http://www.tampagov.net/dept_water/conservation_education/).

Figure 5.8 and 5.9 demonstrate two pie charts, regarding the respondent's opinion on the position of the media and education concerning water conservation.

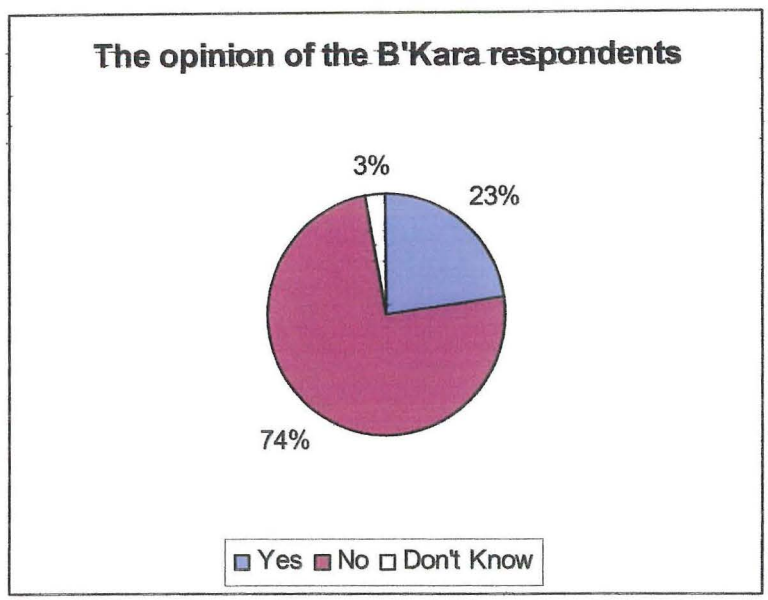


Figure 5.8: B'Kara respondent's opinion on the position of media and education

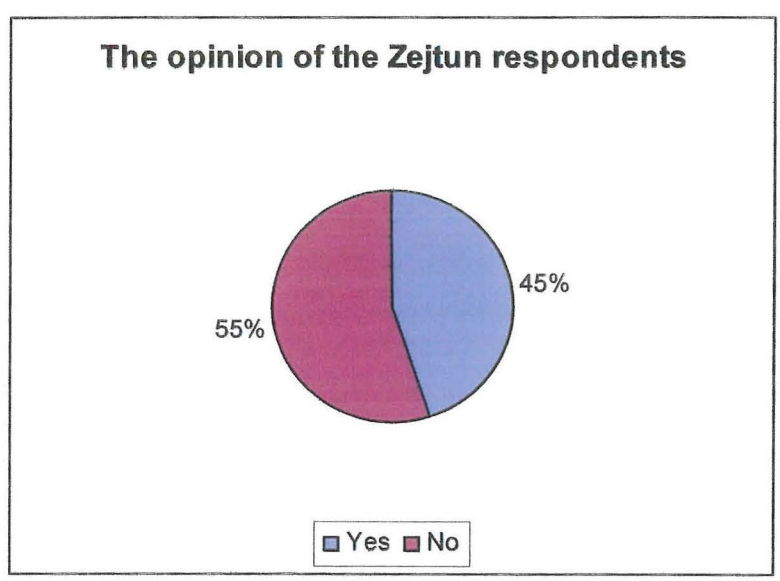


Figure 5.9: Zejtun respondents' opinion on the position of the media and education

74% in figure 5.8 think that the media/education are not giving their utmost for water management improvement. Alternatively, in Zejtun the percentage is 55% (Figure 5.9) which is lower. This question was specified to in general media and education, freeing the respondents' to tackle either the local or the national media/education. Respondents argued that the media broadcasts damages and videos on B'Kara when impacted by flooding. Despite this, no effective action was held by the media, in order to conduct water adverts/programmes or publish tips on newspapers in order to have an effective achievement.

Respondents pointed out that there is always space for change and improvement, and the "*more the merrier.*" In B'Kara 23% and 45% in Zejtun believe that media/education are making inroads for improvement. Since this question, takes the media and education in the same question, half of the respondents in both localities, believed that while the education is doing its part, the media is not participating in this campaign.

Since 'The City of Phoenix', believes that water education is one of the most fundamental lessons to teach, it offers free of charge lessons - available for everyone, (http://www.ci.phoenix.az.us/WATER/wtrteach.html). On the other hand in Philadelphia (U.S.A), water conservation literature is distributed along with mailing bills and local service organizations.

Facts show that the Maltese broadcasting lacks from water informative programmes, but on the contrary, numerous articles are published in recent year's newspapers, such as (The Times, 2007).

Small spots used to be shown, in the past, on the local the television. These, "*makes us more aware about the sustainable use of water resources*", 70% in B'Kara and 43% in Zejtun declared. Section 5.8 embraces, water conservation recommendations advocated by the participants.

5.8 Future Recommendations: declared by the 300 participants

Water use varies widely among companies, sectors, industries and households so water-conservation techniques are diverse. The participants of both localities came up with the following ideas to improve tomorrow's local water situation:

- Promote water conservation benefits and techniques through local newspaper articles, radio and television public service announcements, information centers at local fairs, shopping centers, public displays or exhibits.
- A 10-minute television and radio programme teaches people solutions on harvesting. A one-hour programme every week is useless and tele-spectators will get fed up, so a short programme in peak hours, such as before or after the news will have a lot of views.
- Publicize simple solutions by colourful advertisements on all types of media. This will catch most individuals' attention.
- Promoting water conservation the way the EU advertises smoking prohibition.
- Produce small spots on the local television of the beautiful Maltese scenery and waters. Contrasting with the harm being done, with no conservation and care.
- *"No lesson will be taught if the water bill is increased because it is a wrong idea that by making the water bill more expensive people will learn."* To make people alert on the importance of gathering rainwater, programmes are imperative so that the public can learn how to collect water and use the rain water more frequently in homes.
- On the opposite side, other people stated that, *"the only lesson is taught when bills are finer,"* a 23 year old student precisely stated. Furthermore, *"harassment is the only truthful lesson,"* he continued to declare.
- Teachers, media, NGO's and the politicians need to continuously repeat the fundamental aspects of water conservation.

- The installation of signs such as 'Every Drop Counts' in restrooms or work areas where water is used frequently.
- Water catchments areas and wells must not be buried by the Local Council, to built gardens or a football ground, but must be opened and widen to conserve the daily-needed water.
- People living in plots of flats must agree to dig a well and who decide who must take care of its maintenance each month.
- Enforcement of water laws.
- Conducting more public consultations, participations and meetings regarding water.
- Give incentives which serve as a way of encouragement
- Seek employee suggestions of water conservation ideas.
- Seek the cooperation of local school officials in initiating a program of water education activities.

The Penssylania Environment Protection Department, improves conservation by the promotion of campaigns. With offering, leak detection tips on billing cards, by the purchasing of promotional materials (i.e. buttons, bumper stickers, Tee-shirts) and by conducting workshops for plumbers, plumbing fixture suppliers and builders. Public tours of water treatment plants, reservoirs, pumping stations, and other related facilities are also a means to improve people's knowledge.

5.9 Assessing the flooding problem in both Local Councils

Due to the topographical and environmental features discussed in the earlier chapters, B'Kara is influenced by flooding, with 68%, in comparison with the 0% in Zejtun. These figures are demonstrated in figures 5.10 and 5.11.

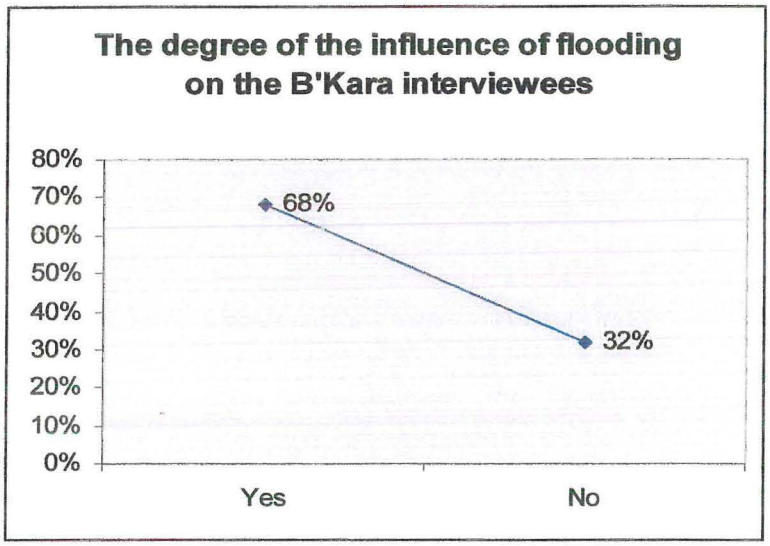


Figure 5.10: The number of B'Kara respondents impacted by flooding

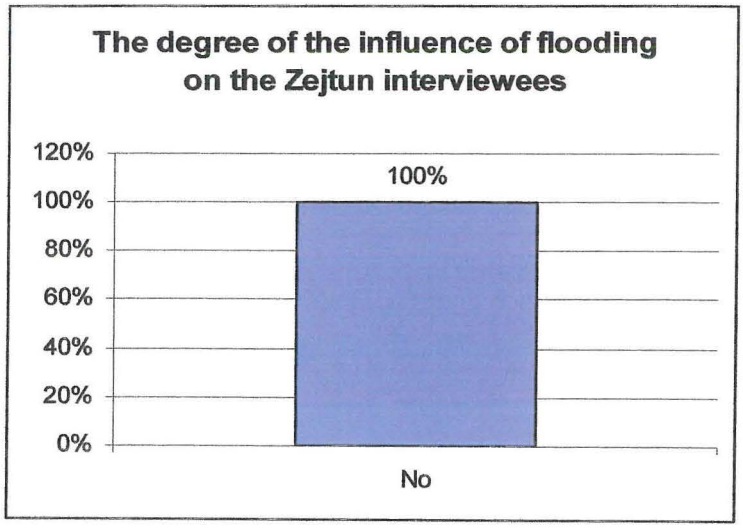


Figure 5.11: The number of Zejtun respondents impacted by flooding

The 32% not affected by flooding, (figure 5.10), live in the outskirts, the flood-prone area is found within the centre of B'Kara.

There is a variation between flooding and surface run-off. Surface run-off occurs when the rate of rainfall on a surface exceeds the rate at which water can be infiltrate the ground, or when any storage or reservoir has already been filled, (http://en.wikipedia.org/wiki/Surface_run_off). Since soil infiltration capacity is reduced, with further construction, water is dispersed along the roads.

Thus, a flood happens when an area of land, usually low-lying, (such as B'Kara and Msida) is covered with water and the water that runs off the land in quantities can be kept in natural ponds or man-made reservoirs, (http://en.wikipedia.org/wiki/Flooding). Plates 5.7 and 5.8 show the difference between the surface run-off in Zejtun and flooding in Msida. Further photos are shown in Appendix VII.

There are few open spaces in B'Kara, being more urbanised than Zejtun. Furthermore, this bottleneck together with the B'Kara topography, changes the surface run-off into a flooding situation.

The fact that no flooding takes place in Zejtun, does not imply that no surface run-off is wasted. Widen roads, more fields and more open-space in Zejtun are factors, restricting flooding to surface run-off.

Plate 5.7: Zejtun surface run-off

Plate 5.8: Msida flooding
Source: Sunday Circle, February 2006.

Further physical and human damages, are discussed in section 5.9.1.

5.9.1 Damages in B'Kara caused by flooding

Floods, are the most frequent type of disaster worldwide, resulting in vast effects. Physical damage to buildings, landslides, deaths due to the strong currents, epidemics and diseases due to the contamination of clean drinking water, scarcity of drinking water and shortage of food crops can be caused due to the loss of entire harvest are all caused by flooding. Although Malta is a small island, flooding is sometimes so severe that it caused deaths, loss of crops, but fortunately never contamined drinking water or caused landslides. Plate 5.9, shows a picture of the damage to crops caused by flooding, (http://www.l-orizzont.com/news.asp?newsitemdi=14297).

The 68% that are affected argued that the B'Kara road-infrastructure is not adapted to the huge amounts of flooding. Its small width it not aligned with the amount of rainwater collection. The strong currents, developing in these narrow roads, causes cars to float in the

streets, collecting in front of people's residence. Moreover, participants continued to state that further damage is caused both to cars and to their dwelling.

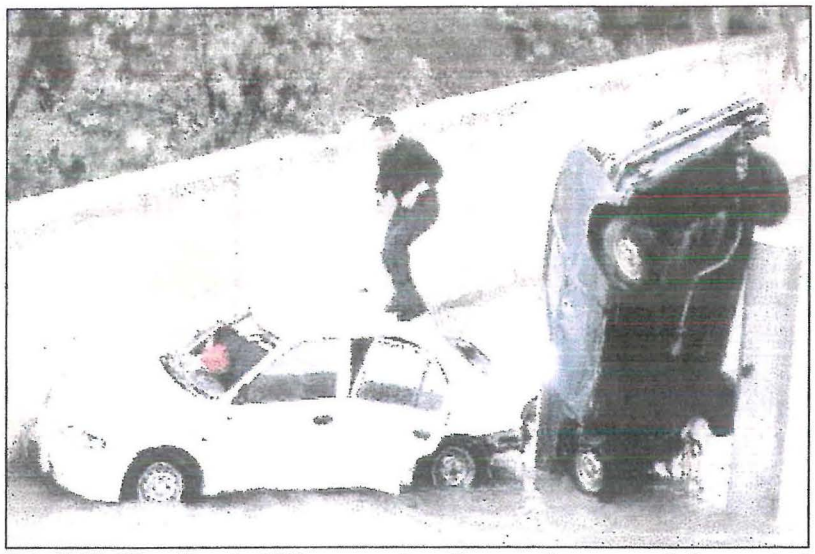
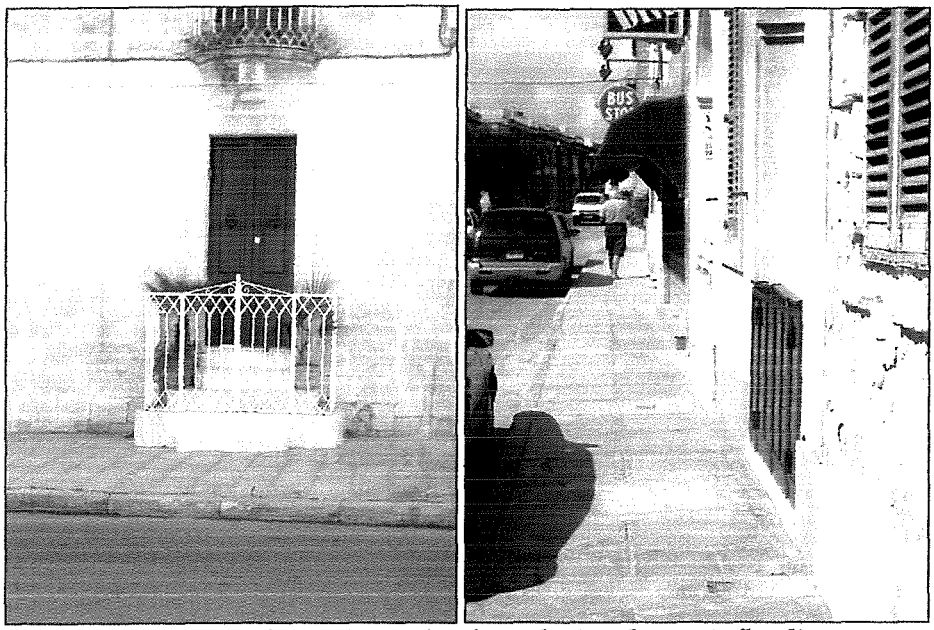


Plate 5.10: Flooding in B'Kara causing damage to cars and danger to human life's
Source: Zammit Lupi

Plate 5.11: Car damage in B'Kara
Source: Haslam, 1997

Flooding in B'Kara destructed cars of 23% of the respondents. They, responded that houses are consequently flooded, causing a lot of interior damage. "*It is often difficult or impossible to obtain insurance policies which cover destruction of property due to flooding*," since floods are a relatively predictable risk, they complained.

Most of the dwellings have plastic covers or tall grates or stairs, (plates 5.12 and 5.13) in order to reduce the inconvenience of the interior flooding.

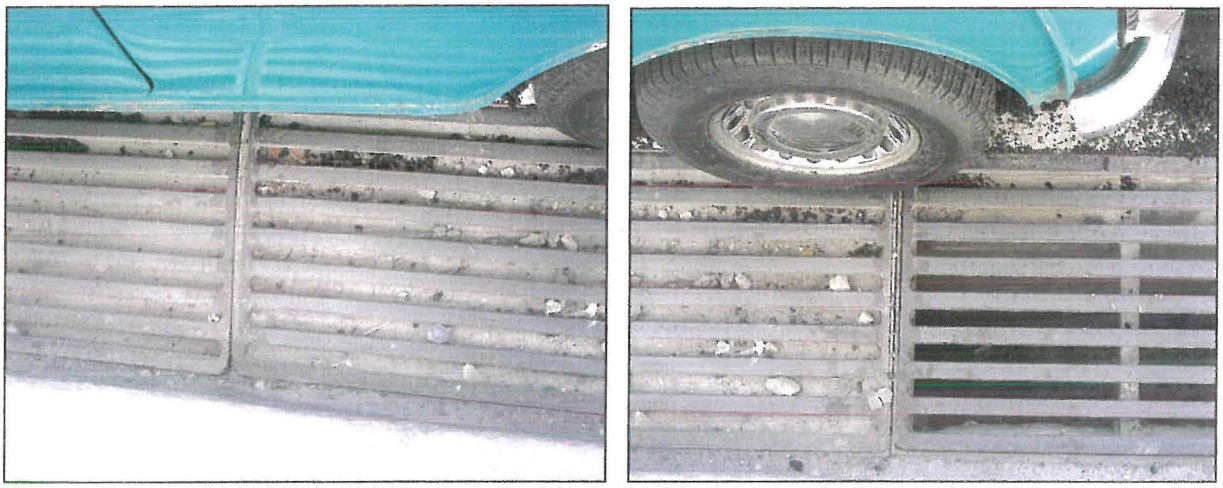


Plates 5.12 and 5.13: Protection for reducing domestic flooding

A 67-year old respondent stated his accident, making six points on his head due to the slip while drying the floor. The majority of the respondents' houses suffer from flooding, especially after a heavy rainfall. This prevents them from going outside or inside the house. A close relative of an interviewee died due to the strong flooding currents in Valley road. Parents interviewed, confessed that although the school is only a few metres away from their residence, they do not sent their children to school.

"They cannot walk on the pavements due to the collecting water that passes from the roads and no matter how attention is being taken to walk in these streets it is still very dangerous, so its' better not to risk," the majority stated.

Respondents complained that pavements are broken and not well-maintained. The canals are obstructed and the air holes (*spralli*) in the roads are too small for the amount of water that accumulates. In Brared Street the road-works were conducted in order to reduce the flood accumulation in one area. Air holes were closed with concrete while arranging the road, (plates 5.14 and 5.15), and according to 59% of the respondents, there use is not ineffective.



Plates 5.14 and 5.15: Air holes blocked with concrete, during road-works

5.10 Work carried out by both Local Councils: to reduce Flooding and improve Water Conservation

"We do not suffer from flooding but regarding water conservation, no work was done by our Local Council," the Zejtun participants; complained. This was commonly stated in Zejtun, and this is indicated in figure 5.12.

Furthermore, a large amount of clean water is lost after a heavy rainfall, and since the *"streets in Zejtun are frequently cleaned this clean rainwater can be conserved somewhere"*.

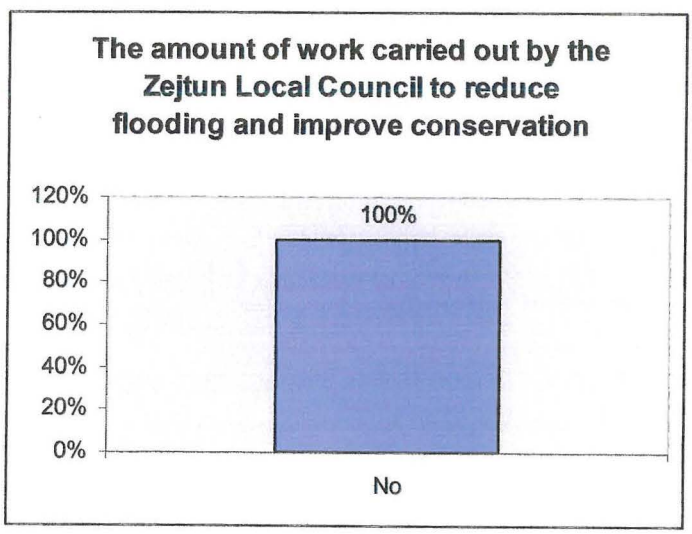


Figure 5.12: Respondents' opinion on the work conducted by the Zejtun Local Council

As stated, this locality's Local Council made the water conservation situation even worse, by burying two large water catchments, building a public garden and a football ground, instead. No canals or air holes where made to gather surface run-off.

Figure 5.10 shows that 68% are impacted by flooding in B'Kara, and 61% (figure 5.13) believe that no work was being carried out by their Local Council.

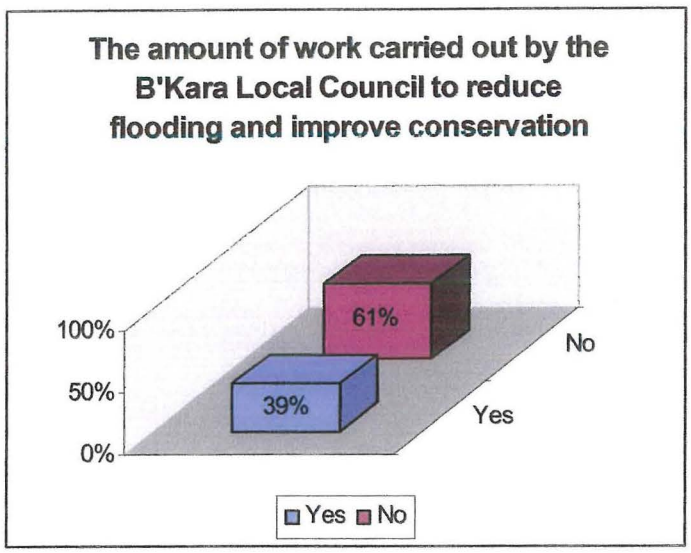


Figure 5.13: Respondents' opinion on the work conducted by the B'Kara Local Council

In the Western Counties, the urban and rural flooding situation is much worse. Thus, floods are carefully managed by defences such as levees, bunds, reservoirs and weirs to prevent rivers from bursting their banks. The situation of Malta is less severe from that of London, and according to, (http://en.wikipedia.org/wiki/Flood#Main_mitigation_strategies), this capital city is protected from flooding by a huge mechanical barrier across the River Thames, which is raised when the water level reaches a certain point. An 'integrated holistic approach' in management planning can, make flooding in B'Kara history.

Although 39% (58 participants) said that work was conducted, they advocated the lack of professionalism in these projects. *"Work was only done for the sake of doing something not to improve the situation,"* they sustained. 10% stated that public participation in Local Council's

plans is indispensable for sufficient improvement. This was done in Cary (North Carolina), where the public took part in water conservation programmes when planned. This consisted of public education, conservation rate structure, new homes structures, and a water reclamation capacity. This program will save 16% in retail water production, reduce operation water costs and delayed the expansions of two water plants, according to the EPA, 2002.

The storm water alarms (plate 5.16), were made in order to give the public advice for flooding. Some participants, living in Valley road, B'Kara disputed that these alarms ring after the storm. This concludes, that there presence is ineffective.

Plate 5.16: B'Kara Storm Water Alarm

In B'Kara, the Local Council opened a number of reservoirs for water storage, in Triq is-Salib Imqaddes. A large amount of water is gathering in them. Large pipes were also made in roads to minimize flooding.

A B'Kara woman suggested that a bridge in Valley road, near Mc Donalds restaurant can be built. In this way, people can cross the street when water is passing by eliminating, the discomfort of staying at home when flooding occurs. This suggestion however, does not eliminate flooding or improves water conservation.

5.11 A politician perspective analysis on water

Mr. Mario Galea, a member of the parliament and a governmental 'whip' participated in this interview, and gave evaluation of a politician perspective on water resources. Mr. Galea thinks that the Maltese public is unconscious on the value of water and more can be done to economize this resource. He is very conscious about water resources and conservation, due to the fact of the high price of desalinization, *"in fact water is heavily subsidized by the government,"* according to Mr. Galea.

Education is a form of aid to improve situations, informing individuals about water protection and *"Any knowledge will be welcome."* He discussed that unfortunately not enough importance to water is given by the media and schools.

"Much more must be done today and not tomorrow." This statement shows that Mr. Galea is willing to improve the water conservation situation. But, on the long-run quotations do not change things, it is action that does.

The governmental 'whip' proposed that the government should encourage any type of households, to own a well and should include wells together with water reservoirs in Governmental Housing Units. Children must be educated from an early age on water costs, moreover must be informed about convenient ways on water daily economization.

Local Councils can also act as change agents, to sensitize communities about the importance and significance of water conservation, according to Mr. Galea.

5.12 Chi-Square Test (X^2)

The Chi-square Test (X^2) was used to measure, the significance correlation between, Water Conservation in both localities and if this conservation, is impacted by flooding.

The data of the number of people, adopting conservation and harvesting in Zejtun and B'Kara is shown in the table below:

	Water conservation
Zejtun	81
B'Kara	79

Table 5.3: RWH of the 300 respondents in Zejtun and in B'kara

	Flooding
Zejtun	0
B'Kara	102

Table 5.4: The data of number of people affected by flooding in Zejtun and B'kara

A Chi-square Test (X^2) with 5% level of significance is performed to determine whether the way people are affected by flooding at Zejtun and at B'Kara is related to how much people conserve water. Check whether this is statistically significant or simply due to chance.

Null Hypothesis (H_o) -

There is no systematic relationship between the way people are affected by flooding and water conservation

Alternative Hypothesis (H_1) -

There is a systematic relationship between the way people are affected by flooding and water conservation

A Chi-square table (Appendix VIII) is used to compare the Observed frequency with the Expected frequency. The critical value is consulted by the table of the chi-square distribution. If the critical value exceeds, the calculated X^2 statistic which is 77.2, always with the appropriate degrees of freedom (4), the way flooding affect RWH is due to chance. The calculated chi-square statistic (77.2) exceeds the critical value or X^2 crit (9.49) using the 5% level of significance (0.05). In this case the Null Hypothesis (H_o) is accepted and the Alternative Hypothesis (H_i) is rejected.

Therefore, there is no systematic relationship between the amounts of flooding of a locality with water conservation.

Chapter 6

Conclusions and Future Recommendations

6.1 Improvements regarding Water Conservation

An integrated approach towards regulation, planning and enforcement is essential for further advancement in this sector. The Maltese legislation has permitted water conservation to be part and parcel of Maltese tradition for considerable time, but despite the laws, this conservation has not been implemented carefully. This is due to the several political, social and economic constraints. The ever-increasing population and economic activity is leading to excessive water demands and pollution. Despite this, water conservation is not yet part of our daily duty and so already restrained water resources will lead to further competition and conflicts. The latter statement is clearly shown in the results of the interviews, where the water conservation consciousness of both localities under review is much higher than the practise of water conservation.

The availability of water is further impacted by either direct or indirect use. This situation calls for integration between various sectors related with water resources and this approach is defined by IWRM. This concept can be utilized for the successful implementation of water conservation. It is a process developed in 2002, at the Johannesburg World Summit on Sustainable Development by the GWP promoting the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner. All this is done without comprising the sustainability of vital ecosystems, (Clausen and Fugl, 2001). This sustainability of Malta's water resources in a holistic manner is further encouraged within the Maltese legislation with accession to the EU, (www.mepa.org.mt). The improvement of the agreement leads to an integration between different sectors, including the administrators, the civic public, NGO's and the EU. This statement can be defined by the term 'holistic'.

6.2 Water Conservation: how can it be tackled?

Governance crisis leading to the lack of management influences a water crisis. Appropriate ways of co-ordination policy making, planning and implementation must be employed in order to achieve an integrated approach. This is only attained by the sectoral, institutional and professional boundaries taking in account complex issues raised with water resource management. The latter is the aim of the IWRM, which further facilitates this implementation and can increase the degree of water conservation in both localities. The long-term existence of IWRM, in the global agenda has attracted significant attention in water and environmental conferences. Despite this, neither its meaning has never been defined, nor has its implementation been fully addressed.

Different water perspectives and interests are brought up with the concept of the IWRM. Building bridges between different academic disciplines, sectoral and political interests are

involved in this water resources management. The latter, will be successful with an effective degree of effort, will and enforcement, involving many political sectors - the fuse of change. Three fundamental factors are sufficient to plan and implement this management. These include that;

- The management plan must be realistic to the real world situations
- Financially feasible to the country's resources
- The available assets for technical work is needed

Goals, interests, demands and challenges vary from place to place. Subsequently, this results that a tailored management plan is indispensable to be valuable to the country's needs. Each country's needs and resources change the way the country must face this issue.

6.3 Changes in Mentality

In order to achieve a successful implementation of water conservation, the vital pressures and awareness from the NGO's together with the civic public help the implementation of the action by the politicians. The latter can be implemented by the bringing of water resources issues, to the top of the political agenda. This acts as a fundamental and long-term success of sustainable water resources management, (Clausen and Fugl, 2001).

The principles, concepts, ideas and recommendations must be insightfully tested, refined and developed. Furthermore, this practical application in water resources development and management around the world will be executed. This 'IWRM' involves a practical application, entailing the top-down and bottom-up participation of all stakeholders from both the national to the local level, (Clausen and Fugl, 2001).

6.4 Recommendations for Further Study

"Improvements have financial cost but non-reacting to problems, have higher economic costs. Therefore, either we act now or it is too late."

This quotation is taken from the film 'The Day after Tomorrow' which states, that the immediate process of putting policy into practice is essential for the improvement of the country's overall resource, in this case the water asset. Policy decisions can help in the setting up of the necessary legal, institutional and implementation mechanisms. These can improve the overexploited and polluted Malta's water resources. In the long run this will assure long-term sustainability, (FAO, 2006). To promote and ensure sustainability a national water policy and vigorous support of all Maltese citizens is needed. Once endorsed by all stakeholders, this will serve as the basis for the development of a set of legal, institutional and operational instruments and programmes. This aims in guaranteeing a sustainable supply of water by its conservation for the benefit of the Maltese community as a whole.

More enforcement of the Maltese constitution on the environment will be allowed, with the monitoring of the water quality standards and the environmental performance. Water quality, waste and storm water must be incorporated in this monitoring. All these three impact the three pillars of sustainability which are;

1. The society,
2. The environment and
3. The economy in some way or another

If this monitoring results against the agreed commitments, penalty mechanisms take place. Only in this way the regulated targets will be achieved.

Locally, the water in the underground aquifers is not given the sufficient time to replenish itself. Its ever-increasing depletion is further encouraged, due to the country's obsession of

directing surface water runoff as quickly towards the sea. The latter statement consists of dispersed attempts at solving micro-problems. This approach suits us no more and a required holistic approach is required for problem-solving. Sufficient storm water management features such as dams, basins, reservoirs, natural ponds, and pipes should be part of each catchment, in order to control the storm water runoff.

Surface or ground water can be used for the supplying of the domestic, irrigation, stock and industrial water. Alternatively, storm water can be reused for potable or non-potable purposes, in order to minimise the demands on conventional water supply systems.

The number of factors that, affect the control of surface runoff must be taken into consideration. The climatic factors and catchment characteristics are the two categories, imperative to this control. Climatic factors depend on, the storm itself which is beyond human control. On the other hand, the catchment area, are within human control. This implies that water reservoirs must be present in every locality with, micro or macro-catchment areas present in at least every house. The reservoir in the locality must be compared thoroughly with the land use, the type of rock, the catchment shape, catchment area and the valley/stream frequency of every locality, (Scicluna, 2004). This is indicated within the results of section C of the interview (Appendix III), which illustrate that the flooding frequency of B'Kara, is different from that of Zejtun. The road infrastructure and the topography of both localities are the two major issues impacting this situation.

Local Councils in the flood-prone areas, including B'Kara, Qormi, Msida and Marsa attempt to solve flooding problems. However, limited human and financial resources restrict the efforts. Thus, this permits a coordinated large-scale solution to improve the local water situation. Not sufficient work is done by Local Councils, government departments, and

individuals, since the groundwater supply keeps decreasing, increasing the damage caused by storms.

Attempts for further improvement are fragmented and uncoordinated, caused by mismanagement and effective planning. Conferences are supposed to promote solutions and benefits which are a tough task, compared with the on-going discussions on water problems. Theory is efficient for management but practise and action are much more indispensable.

The state must change its course of action. Its implementation must have an overall view of the solutions and hence must adopt a holistic approach. There tends be an adoption of short-term action rather than the consideration of long-term solutions.

6.5 A Long way forward

The integrated work of architectures, engineers, geologists and hydrologists, with the help of politicians, can make a difference in moving towards the implementation of water conservation measures. Such further recommendations can include:

- The improvements within the roads infrastructure
- The construction of reservoirs in flood-prone areas
- The frequent cleaning of catchment areas
- Further regulations enforcement for well owning, in both houses and apartments

Financial resources are of strategic importance, for achieving an optimal outcome in the planning infrastructure construction. These assets are used at their utmost, with knowledgeable people together with strict enforcement and promotion. The economic asset will give the incentives necessary, for the politicians to make the right choice concerning water management.

Flood evasion and water conservation strategies can be adopted, with a mentality change amongst the Maltese citizens and politicians. The Maltese public must apprehend that valley and road littering create, blocked storm water networks and eventually flooding. It is also rather frequently that unscrupulous citizens throw litter such as white-household appliances in valleys and water catchment areas. Thus, during heavy showers on the Islands, the storm water runoff carries this debris downstream. This block carefully designed pipes and constructed storm water network. Thus, this creates flooding of adjacent areas causing, hundreds and thousands of pounds of damage. Cleaning must be carried out at regular intervals, rather than a one-off cleaning exercise. The politician must comprehend that the invested finance in the cleaning of water reservoirs, water catchment areas and valleys do not result in economic loss.

Currently, there is always a choice. It is either continuing in directing water towards the sea or acquiring a holistic storm water management approach. Thus, storing it and re-using it for secondary purposes. In the first approach, financial loss is inevitable due to the discarding of the valuable resources. In the second approach, there is a lot of economic gain, subsequently with damage reduction caused by storm runoff together with the underground aquifers replenishing. Thus, this is harder to implement due to the involvement of effective preparation, realistic plan designs, together with practical management plans. "*The quicker we adopt a holistic approach, the quicker we reap the benefits,*" an interviewee stated precisely.

In earlier periods, the water was not easily obtained, forcing the civic public to walk long distance for this 'strategic resource'. In contrast, today, humanity treats water as if it were an infinite resource. Government bodies and Water Authorities sometimes, make citizens believe that water is 'safe' and not a global alarm. Awareness and action lies entirely upon the public, as the citizens need to become their own educators, physicians and innovators.

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Appendices

Production Use	WSC Billed (000m3)	WSC Unbilled	GW	RO	Private Treated effluent	Runoff harvesting	Total
Domestic	12 620	3 686	1 000	1 000		2 000	19306
Tourism	1 134	331	500				2965
Farms	1 336	390	500				2226
Agriculture			14 500		1 500	2 000	18000
Commercial	1 247	364					1611
Industrial	941	275	1 000		500		2716
Government	818	239					1057
Others	869	254					1123
Total consumption	18 965	5 540	17 500	1 000	2 000	4 000	49005
Real losses		9 636					9636
Total + losses	18 965	15 176	17 500	1 000	2 000	4 000	58641
WSC:							
Total apparent losses	5 540	16%					
Total loss	15 176	44%					

General water accounting matrix, 2003*
Source: FAO, 2006

*Unbilled consumption was estimated on the basis of the volumetric distribution of the billed consumption

Source: Cardona, 2006

SECTION A: SOCIO ECONOMIC DATA

1. Male _____ Female _____

2. Age: 13-25____
   25-35____
   35-45____
   45-60____
   60+_____

3. Occupation:
   - Self-employed
   - Business entrepreneur
   - Private sector employee
   - Civil servant
   - Student
   - Housewife
   - Retired
   - Other specify _____

SECTION B: PUBLIC AWARENESS ON THE VALUE WATER RESOURCES IN THEIR HOME

4. Do you think that the Maltese public is conscious about how valuable water is to our life and our country? Yes/No _____

   What is the reason for you answer? _____

5. Are you personally conscious about water resources and conservation?
   Yes _____ No_____

6. Why? _____

7. Do you know that water is a very scarce resource in Malta and if this problem accumulates it will be a problem for the whole country?
   Yes _____ No _____

8. Do you harvest, conserve and manage rainwater in any way in your household? Yes/No _____

9. If 'yes' how do you manage and conserve rainwater?
   _____

10. If 'yes' for which purpose do you utilise rainwater?
    _____

11. What are the benefits of managing rainwater in you household?
    _____

12. If 'no', what is the reason for not utilising rainwater?

    _____

13. What do you think is the main reason for not knowing about how to conserve rainwater in your home? _____

14. If you know the solutions, do you think you are willing to take more care of your water? _____

15. Presently do you think that the media and school education is giving enough priority to the conservation of water and how to reduce its loss?

    _____

16. Personally what more do you think can be done?

    _____

SECTION C: ASSESSING THE PROBLEM OF FLOODING

17. Are you affected by flooding? Yes_____ No_____

18. If 'yes' in what way? _____

19. Had your Local Council carried out any works in your road to reduce the flooding problem or to conserve rainwater? Yes/No_____

20. If 'yes' please indicate what work has been carried out?

    _____

Appendix IV: WSC Leaflet – distributed after every interview conducted

KEMM TUŻA ILMA

UŻA DIN IL-PAGNA BIEX TARA KEMM TUŻA ILMA F'ĠIMGĦA

UŻU TA' L-ILMA KULL DARBA ILLI....	AMMONT (estimi)
TIEĦU BANJU	80 LITRU
TIEĦU DOĊĊA	30 LITRU
TIFLAXXJA T-TOILET	7 LITRU
TAĦSEL WIĊĊEK / IDEJK	3 LITRI
TIXROB	0.5 LITRU
TAĦSEL SNIENEK	1 LITRU
TAĦSEL IL-PLATTI	20 LITRU
TAĦSEL IL-ĦWEJJEĠ	100 LITRU
OĦRAJN	IKKALKULA INT

Imla t-tabella ta' hawn taħt biex tkun taf kemm taħli ilma f'ġimgħa waħda.

TKUN SORPRIZ!

Numru ta' persuni fir-residenza: _____

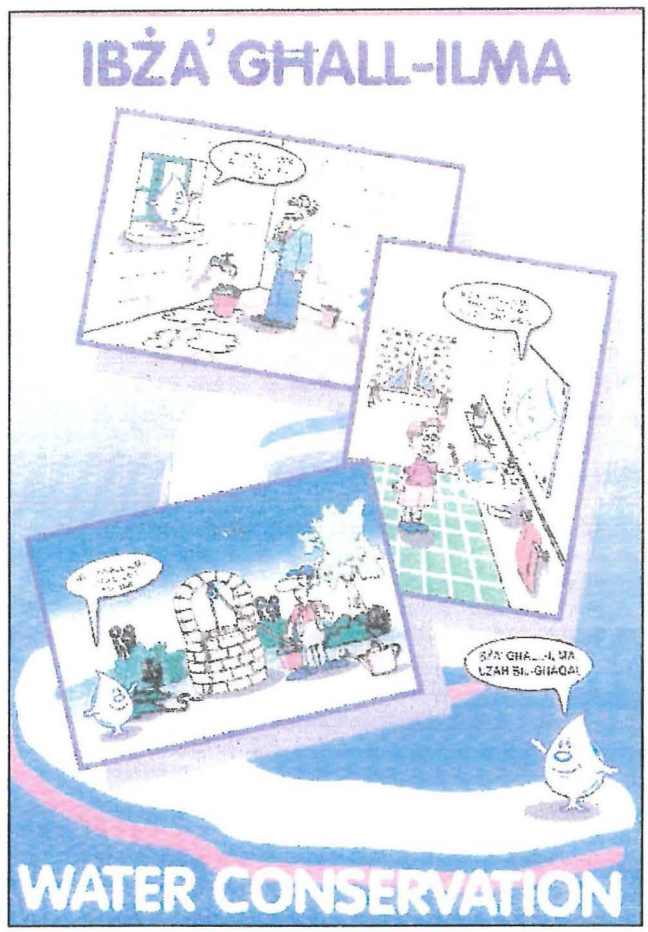
F' l-aħħar tal-ġimgħa immultiplika t-total ta' ilma li użajt bin-numru ta' residenti fid-dar. B'hekk se jkollok ideja ta' kemm jintuża ilma ġod-dar.

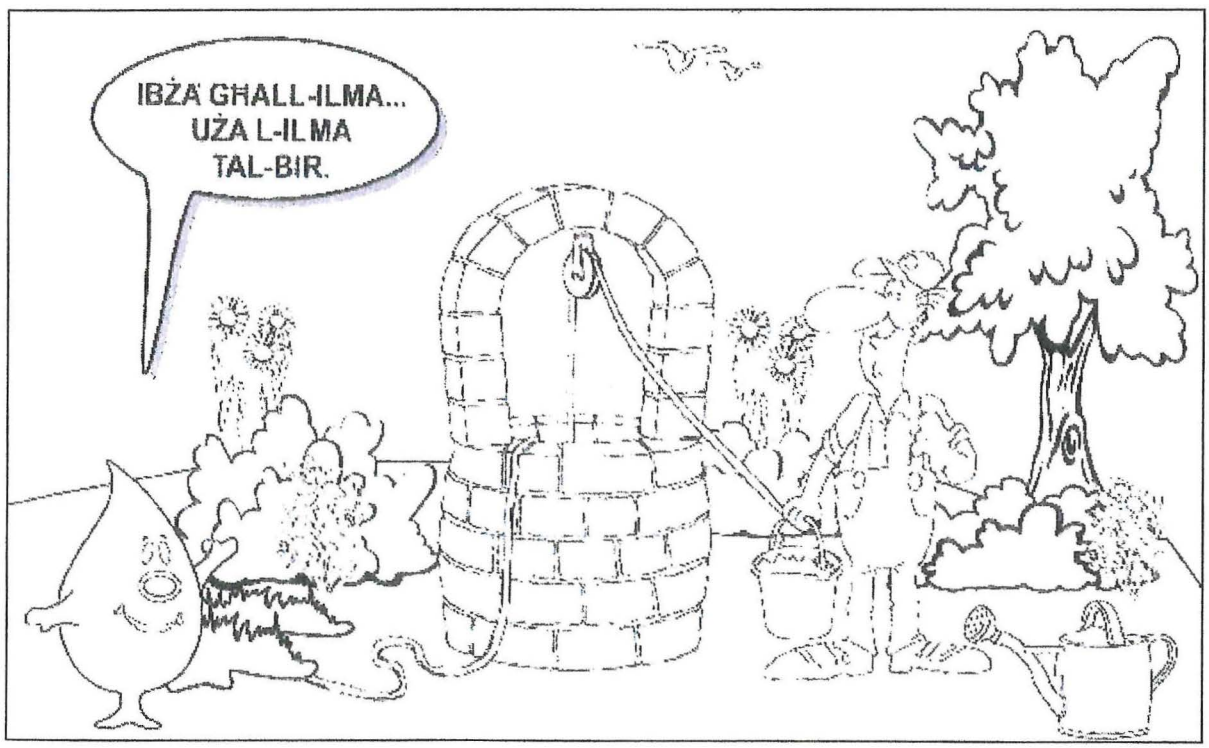
Ibża għal l-ilma, taħliex. Naqqas il-konsum!

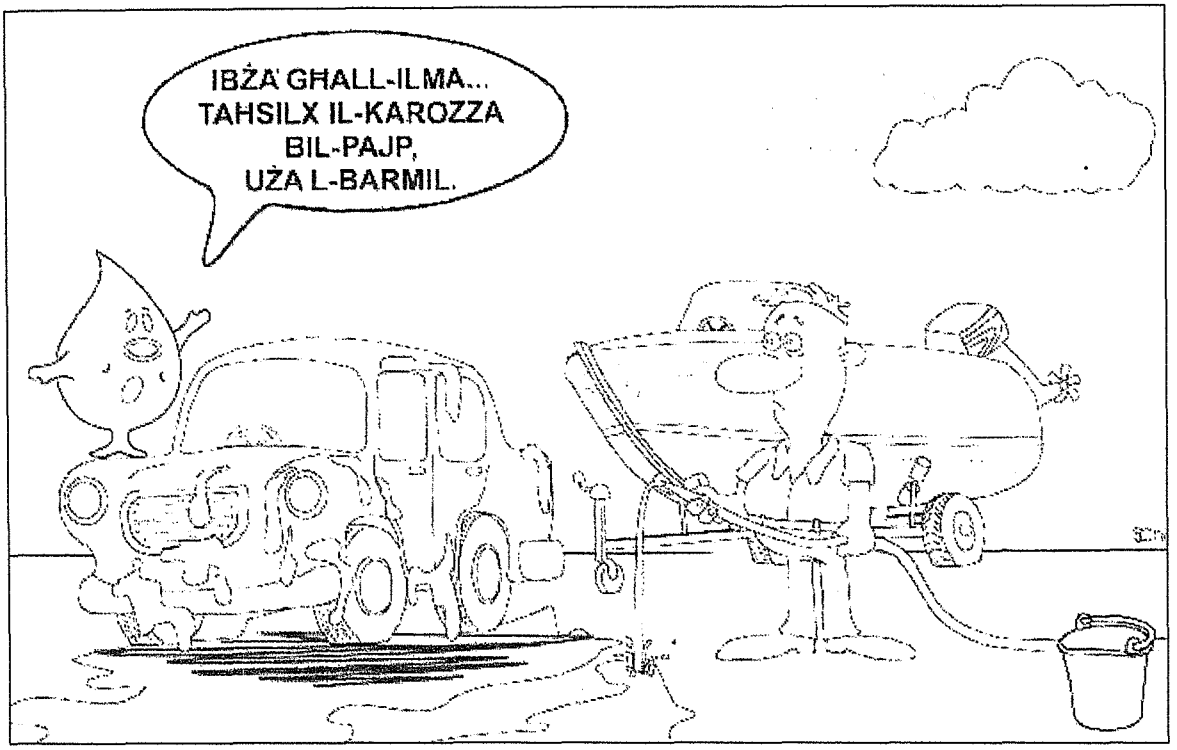
WATER SERVICES CORPORATION

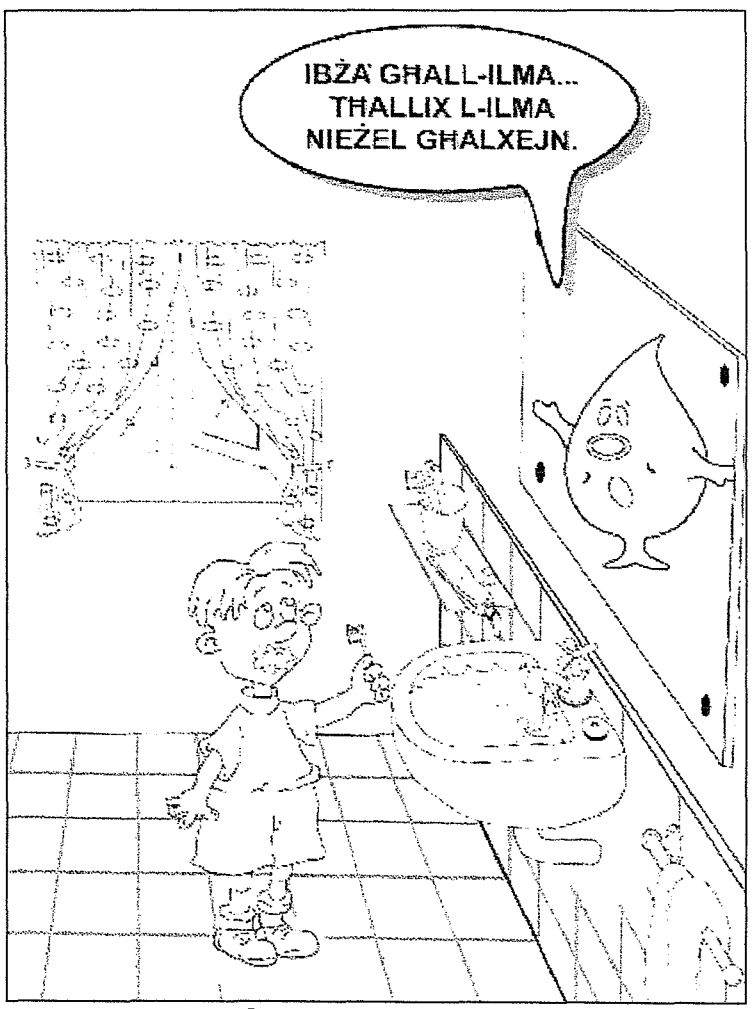
UŻU TA' ILMA	it-Tnejn	it-Tlieta	l-Erbgħa	il-Ħamis	il-Ġimgħa	is-Sibt	il-Ħadd	TOTAL
Tieħu Banju								
Tieħu Doċċa								
Tiflaxxja t-Toilet								
Taħsel Wiċċek / Idejk								
Tixrob								
Taħsel Snienek								
Taħsel il-Platti								
Taħsel il-Ħwejjeġ								
Oħrajn								
TOTAL F' L-AĦĦAR TAL-ĠIMGĦA								

Source: www.wsc.com.mt


IBŻA' GĦALL-ILMA
WATER CONSERVATION


IBŻA' GĦALL-ILMA...
UŻA L-ILMA
TAL-BIR.





Source: www.wsc.com

Water is a precious resource which is costly to produce. In Malta around **60%** of our drinking water comes from **reverse osmosis plants** which consume a lot of electricity.

Save money, **conserve water** because it is the **right thing** to do and help the environment by following these simple yet effective water saving tips:

1. Repair **dripping taps** now! A common dripping tap can easily waste up to 2000 litres per year, which is a lot of water.
2. Don't leave the **tap running while you brush your teeth**. A family of four can save up to 7000 litres of water per year by this simple measure.
3. Do not use **running water to thaw** frozen foods. Defrost food overnight in the refrigerator which saves even more energy because as the frozen item thaws, it helps keep the fridge cool.
4. Never run the **dishwasher or washing machine without a full load**. This practice will save water, energy, detergent, and money.
5. When buying a new washing machine or dishwasher, **check the water requirements** of various brands and models. Some use less water than others. Check whether the appliance is **Class A** because these use less water and electricity.
6. Just taking a **five minute shower** every day, instead of a bath, will use a third of the water, saving up to 400 litres a week.
7. **Reduce the toilet flush volume**. Try completely filling a 1 litre glass bottle with water and placing it in the cistern. This will save a litre of water on every flush. However, beware not to obstruct moving parts inside the cistern!

Printed on recycled paper

Check for hidden leaks

Your plumbing system may have a hidden leak that wastes hundreds or even thousands of litres of water per annum. This is both wasteful and will hurt your pocket. Follow these simple tips to check your internal water system.

- At night before going to bed, **check that all taps are closed** and that **all appliances** such as washing machines and dishwashers are **off**. Toilet cisterns too must be full.
- Note the **reading of your water meter** and compare it with the reading on the following morning. If it's not the same, there may be a leak somewhere which needs to be checked.
- If you do have a leak, the likelihood is that the **toilet cistern is at fault**. However, please note that some toilet designs allow water to leak unseen straight into the bowl from behind. So just because you cannot actually see the water running into the toilet bowl, it doesn't mean that you have no leak. Get a **competent person** to check it out.
- If your toilet flushing systems are working correctly, all taps and appliances are shut, but you still register a changing night reading, you may have an **"underground" leak**. This may lead to heavy water consumption. The Water Services Corporation offers a free detection service in such cases. This free service is only available in cases where there has been a significant and unexplained rise in water consumption and where such consumption is much more than the established benchmark.

For more information contact our Customer Care department on freephone or log on to our website

8007 2222
www.wsc.com.mt

WATER SERVICES CORPORATION

Tahlixilma

Source: www.wsc.com

Appendix VII: Photos: Surface run-off in Zejtun and flooding in B'Kara and Msida

Flooding in Msida
Source: Sunday Circle, 2006

Source: www.di-ve.com

Flooding in B'Kara - Source: http://www.l-orizzont.com/news.asp?newsitemid=14243

Appendix VIII: Chi-Square Test Table (X^2)

df	0.1	0.05	0.02	0.01	0.001
1	2.71	3.84	6.64	7.88	10.83
2	4.60	5.99	9.21	10.60	13.82
3	6.25	7.82	11.34	12.84	16.27
4	7.78	9.49	13.28	14.86	18.46
5	9.24	11.07	15.09	16.75	20.52
6	10.64	12.59	16.81	18.55	22.46
7	12.02	14.07	18.48	20.28	24.32
8	13.36	15.51	20.29	21.96	26.12
9	14.68	16.92	21.67	23.59	27.88
10	15.99	18.31	23.21	25.19	29.59
11	17.28	19.68	24.72	26.76	31.26
12	18.55	21.03	26.22	28.30	32.91
13	19.81	22.36	27.69	30.82	34.55
14	21.06	23.68	29.14	31.32	36.12
15	22.31	25.00	30.58	32.80	37.70
16	23.54	26.30	32.00	34.27	39.29
17	24.77	27.59	33.41	35.72	40.75
18	25.99	28.87	34.80	37.16	42.31
19	27.20	30.14	36.19	38.58	43.82
20	28.41	31.41	37.57	40.00	45.32
21	29.62	32.67	38.93	41.40	46.80
22	30.81	33.92	40.29	42.80	48.27
23	32.01	35.17	41.64	44.18	49.73
24	33.20	36.42	42.98	45.56	51.18
25	34.38	37.65	44.31	46.93	52.62
26	35.56	35.88	45.64	48.29	54.05
27	36.74	40.11	46.96	49.65	55.48
28	37.92	41.34	48.28	50.99	56.89
29	39.09	42.56	49.59	52.34	58.30
30	40.26	43.77	50.89	53.67	59.70
40	51.81	55.76	63.69	66.77	73.40
50	63.17	67.51	76.15	79.49	86.66
60	74.40	79.08	88.38	91.95	99.61
70	85.53	90.53	100.43	104.22	112.32
80	96.58	101.88	112.33	116.32	124.84
90	105.57	113.15	124.12	128.30	137.21
100	118.50	124.34	135.81	140.17	149.45

Source: Author's notes