



Retrofitting a 3 star hotel as a basis for piloting water minimisation interventions in the hospitality sector



Kevin Gatt*, Celine Schranz

Department of Spatial Planning and Infrastructure, Faculty for the Built Environment, University of Malta, Msida MSD 2080, Malta

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ABSTRACT

The poor state of Malta's groundwater resources provides clear evidence of the need for different yet complementary strategies to secure the long term sustainability of groundwater bodies which have long been abused through increased abstraction for non potable use. In line with the hierarchy for the management of natural resources, minimisation plays a significant role as this would guarantee lower abstracted volumes from groundwater.

This paper outlines the results from a pilot project aimed at retrofitting guestrooms in a 3 star hotel with low flow aerators and shower heads and with volume displacers in toilet cisterns. Water consumed before and after the interventions, based on meter readings, the impact retrofits may be established. The hypothesis whereby low flow, non interventionist retrofits can achieve significant water savings at a low cost, without disruption and with a payback period of less than three months, can be tested. Malta's tourism industry is sizeable and the largest water consumer from all economic sectors. The results show that the interventions provide appreciable water savings and can be easily replicated both in other buildings thereby contributing to a reduced water footprint.

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1. Introduction

Hot summers, mild winters and a limited amount of rainfall in the Mediterranean have been a cause of water scarcity for many countries since the 19th century. Population growth and imposed tourism loads increase the pressure on water yielding aquifers contributing to a deteriorating situation (Stournaras, 2010). This problem is accentuated in the southern part of Europe, including places like Malta, Greece, Cyprus, Italy and Spain as well as in the western part of the Middle East, including Israel, Lebanon and Turkey (Christodoulou, 2010) as well as in parts of Spain, notably Mallorca (Tortella and Tirado, 2011).

The climate of the Maltese Islands is typically semi-arid Mediterranean, characterized by hot, dry summers and mild, wet winters. The water-related consequences of semi-arid climates include variations in both inter-annual and intra-annual rainfall patterns, high-intensity and short-duration rainfall events and seasonal scarcity of precipitation during the peak seasons when water requirements are highest (Food and Agriculture Organization of

the United Nations, 2006). Such scenarios increase the pressures on groundwater resources, their quality and yield.

Global climate models foresee that, in the near future, rapid fluctuations will occur causing extreme hot temperatures and intense rainfall events both of which negatively affect water volumes stored in aquifers. As far as predictions go for the Mediterranean and Malta, climate change will cause temperatures to increase by up to 2.8 °C, sea levels to rise by 30 cm and the precipitation to decrease by around 1.8 – 4.4% by the year 2100 (Micallef and Sammut, 2010).

Some of the most critical effects on the tourism industry, as a result of climate change, include a reduction of available water due to excessive abstraction, an increase in potable water demand, an increase in the contamination of fresh-water bodies, the reduction in water storage and an increase in water withdrawals (Stournaras, 2010). Most of these consequences are also confirmed in Malta's Second National Communication to the UNFCCC (Gatt, 2010) and will further contribute towards stressing groundwater resources.

Water scarcity in Malta is a reality that few dare contradict. The total abstraction of groundwater is estimated to be about 34 Mm³/annum (Malta Resources Authority, 2005). It includes water extracted by the Water Services Corporation (WSC) and all legal and illegal unmetered extraction. Such abstraction levels represent 11 Mm³ more than the Malta Resources Authority's (MRA) recommendations for sustainable extraction (Food and Agriculture Organization (Food and Agriculture Organization of the

* Corresponding author.

E-mail addresses: kevin.gatt@um.edu.mt (K. Gatt), celineschranz@gmail.com (C. Schranz).

United Nations, 2006). Groundwater abstraction for potable supplies amounts to around 14 Mm³ (National Statistics Office, 2009). This begs the questions as to whether the difference (20 Mm³) between estimated total groundwater abstraction (34 Mm³) and WSC metered abstracted water (14 Mm³) confirms an unsustainable practice that currently prevails.

Aquifer recharge is dependent on the 545.3 mm of average annual rainfall (NSO, 2012a) which falls on Malta's limited surface area of 316 km². This recharge potential has been progressively hindered by a high urbanisation rate, which reached 27.7% in 2005 (NSO, 2010) and limited water conservation infrastructure. The population in Malta in 2011 stood at 416,055 (NSO, 2012b) implying a population density of 1317 inhabitants/km², making it one of the most populated countries in the world (World Bank, 2012) and therefore increasing pressures on water resources.

Since the early 1980's, desalination plants have played a major role in the production of potable water. In 2011 desalinated water accounted for 55% of total water production (NSO, 2012a) reinforcing Malta's dependency on alternative water resources to satisfy demands for water. This scenario may have caused people to take water resources for granted and to have limited interest in water conservation (Food and Agriculture Organization of the United Nations, 2006) relying on the 'topping up' potential desalination plants have vis a vis satisfying water demand constraints.

Billed water consumption is the only direct form of consumption measurement. Potable water is produced and distributed solely by the WSC, a state owned entity, and all water connections to buildings are metered at the point of consumption for billing purposes. This provides a means to monitor individual client consumption within buildings. On this basis one notes that whilst 67% of total consumption is attributed to consumption from within households, 23% of the remaining consumption is taken up by the tourism sector (NSO, 2009). This metered amount does not include the use of other water resources, such as groundwater, legally or illegally abstracted, which is sold to tourism establishments to supplement potable metered supplies. As there is no abstraction charge for groundwater, it commands a financial advantage on metered water, making it an attractive substitute for use in hotels.

Malta's attracts 1200,000 tourists annually, and rising, which translates itself into over 7300,000 bed nights (NSO, 2012d, 2013a). From an economic standpoint, tourism accounts for 11.82% of Malta's GDP (NSO, 2013b) as well as a sizeable workforce. Three star hotels provide the highest number of bed nights per year (1452,659) when compared to two star hotels (59,341) and other forms of non-hotel based tourist accommodation (903,127) (NSO, 2012c; NSO, 2012d; NSO, 2013a; NSO, 2013c). Since the income per bed night from three star and lower rated hotels is lower than that of top end of the range hotels, every effort is done by these enterprises to minimise their capital and recurrent costs to achieve better profitability levels. This enhances the acceptability of retrofits by hotel managers.

The hotel chosen for this study had one peculiarity in that it had no kitchen, laundry or restaurants present in the building as these activities were subcontracted. The study therefore maximised the effect retrofitting could have on water conservation from guestrooms only. The hotel was constructed forty-one years ago at a time when the consideration for water conservation was not as important as it is today. Water consuming devices during that time were not designed to reduce water consumption and even though eight years ago there was a change in ownership of the hotel, necessitating a degree of refurbishment, water conservation does not seem to have been a priority. This made this hotel an ideal target for retrofitting with the aim of promoting water conservation.

By avoiding the consumption of a resource we not only safeguard that resource but we also avoid having to manage the consequences of its use. To this effect this paper presents the result

of a pilot project carried out in a local 3 star hotel with a view towards determining the potential that low cost retrofit interventions have to lower water consumption at source.

This makes the hotel industry a prime candidate for exploring the potential of achieving water conservation through simple retrofits that do not disrupt the operations of the business and which do not need invasive physical interventions. The pilot project consisted in the:

- reduction in flushing volumes through a volume displacement device¹ of 1.2 l in a traditional 9 l cistern (see Fig. 1);
- replacement of aerators on taps with proprietary² ones rated at 4.5 l/min²;
- replacement of showerheads with proprietary ones having a rating of 8 l/min².

The metering system present within the hotel facilitated a water accounting exercise to be undertaken in order to isolate consumption associated with bedroom activity only as well as records to differentiate between "mains supplied"³ and "imported"⁴ water.

The success of this pilot would permit low cost, non-intrusive retro fitting techniques to be promoted as a strategy for water conservation in existing medium to low-end hotels.

The concept behind this study was to determine the amount of water that could be saved through the installation of non-destructive and inexpensive interventions, affordable to financially sensitive enterprises due to their short payback period. The achievement could be used to showcase such initiatives with a view to replicating it in any other sector or building. The success of this pilot, and a replication effort, should lead to lower water supply and groundwater abstraction volumes enabling more water efficient buildings and permitting Malta to move up the water resource management hierarchy.

2. Literature review

A positive socio-economic impact generally results from growth in the tourism sector. However, there are also negative environmental impacts associated with the considerable volume of water consumed. Tourism can become an environmental liability (Steenhuis, 2010) as it is the second highest water consumer after the domestic sector (NSO, 2009). Such consumption is even more hard-hitting in water-scarce areas. In hotter and drier climates like the Mediterranean, water scarcity is of particular concern as tourists tend to consume more water when on holiday than when at home, forcing water consumption to reach levels of up to 440 l per day (UNESCO, 2006; UNEP, 2009; Gossling et al., 2012). Tourism generally accounts for less than 1% of national water use. However Gossling et al. (2012) have demonstrated that, in the case of Malta, this accounts for 7.3%, significantly higher than other tourism based economies such as Barbados (2.6%) and Cyprus (4.8%) indicating that "islands with high tourist arrival numbers and limited water

¹ A volume displacement device may be a proprietary or vernacular product that is placed in the flushing mechanism in order to reduce the volume of water that is flushed to clean a toilet. Its function is to occupy a fixed volume which would have otherwise been occupied by water which would subsequently be flushed.

² In the case of the latter two, the new design flow rate was at least half that which prevailed prior to the new installation. Moreover, each of the three floors of the hotel was checked to ensure that water pressure was above 1 bar. In fact, the water pressure ranged from 1.8 bar on the third floor to 2 bar on the first and second floors.

³ Mains supplied refers to WSC supplied potable water which is billed through meters installed in all buildings.

⁴ Imported water refers to water delivered to a building by tankers and which water is not of potable quality.

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