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Water Conservation and Resuse Strategy for Ireland

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Introduction

Ireland's recent period of sustained economic growth has seen the level of Irish real GDP almost double in size. Ireland now constitutes almost 1.8% of overall output in the Euro Area. This level of growth is evident in the increase in house building. Between 1997 and 2002, the number of dwellings completed in the Republic of Ireland increased by almost 50% from 38,842 to 57,695, per annum. Construction Industry Federation figures for 2004 show that 74,000 housing units were completed. This continued pace of economic development is posing problems for water supply infrastructures never intended to service the levels of demand being experienced. Consequently there is a countrywide need for investment in additional water supply infrastructure.

Sustainable Demand Management

The traditional approach to meeting increased demand is to augment supply. However, mobilising new resources involves ever higher costs. Increasing water efficiency by reducing the amount of water required to accomplish a given task can significantly contribute towards balancing supply and demand. The water saved as a result of PCC reduction can be used to augment existing supplies. This can be the least cost option, particularly when the environmental and social costs of developing new resources are included in the analysis. Allied to this is the concept of sustainability, which can be defined as *'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'*. An important consideration in itself, sustainability forms a major part of the EU water strategy outlined in the Water Framework Directive 2000. The concept of water conservation and water saving technologies are set to play a major role in our lives.

Economics

In the main, water services in Ireland are delivered to both domestic and non-domestic sectors, by local authorities. Current government policy requires that local authorities should apply charges to the non-domestic sector that reflect the costs (both capital and operational) of provision of water and wastewater services. These charges are applied on the basis of a unit charge in respect of metered water supply. Local authorities are required to achieve universal metering of water supplied to the non-domestic sector by 2006. This is in accordance with the Water Framework Directive 2000 which states that *'Member states shall ensure that by 2010 water pricing policies provide adequate incentives for users to use water resources more efficiently and an adequate contribution of the different users to the recovery of the cost of water services'* These developments will result in technologies that increase water efficiency and reduce mains water useage becoming economically attractive to both domestic and non-domestic users.

Per Capita Consumption (PCC)

Water demand in Ireland is increasing, not only in relation to population growth, but also with regard to changing socio-economic patterns The average per capita water consumption (PCC) for Ireland in 1997 varied between 130 l/h/d to 139 l/h/d. Projections for the year 2018 indicate a PCC of between 146 and 158 l/h/d. Introducing a policy to improve the rate of water efficiency requires a multi-dimensional approach. An important contribution to such policies is the adoption of alternative technologies. Studies carried out in European countries showed that the link between water use and economic growth was broken, where Local Authorities utilised rainwater harvesting and water conservation measures as solutions to water capacity problems. Rainwater harvesting consists of filtering and storing rainwater previously lost to the consumer. It has a significant potential to provide an alternative non-potable supply at relatively low capital and running costs.

The main uses of water in a domestic situation are illustrated in Fig 1. This shows toilet flushing, showering/bathing and clothes washing accounting for almost 80%. Harvested rainwater may be used to replace mains utilisation in the following applications: flushing toilets, washing machines, household cleaning, garden and other external use of water.

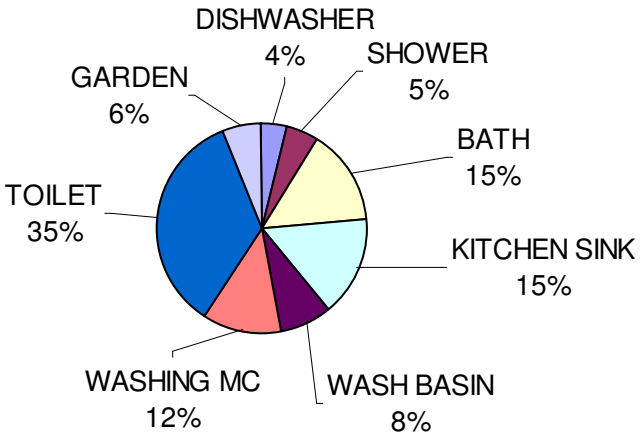

Fig 1 Typical Breakdown of Household Water Use

Rural (Group) Water Supply

In rural Ireland water is supplied to non-mains users, i.e. those who do not have access to a local authority scheme, by the Group Water Sector. These comprise of private and part-private schemes, charged with sourcing and distributing potable water. By the mid 1990s, the part-private sector was providing drinking water to almost 73,000 homes (approx. 240,000 people), while private schemes catered for 50,000 homes (approx. 165,000 people). Taken together, the sector accounted for water provision to 29 per cent of all rural households in the Republic of Ireland. The National Federation of Group Water Schemes (NFGWS) is the representative organisation for this sector in Ireland. New water treatment plants are being constructed by the NFGWS using the Design Build and Operate (DBO) method of procurement for capital works.

To be sustainable, the DBO approach must be financially viable and affordable. The need to minimise cost, particularly operating cost, has focused attention on the size and capacity of water treatment plants. Reducing throughput can minimise volume related charges at the treatment plant. The application of rainwater harvesting to the Group water sector would appear very appropriate.

DIT Research Study

A desk study conducted by the Department of Civil & Structural Engineering, DIT (Ireland) evaluated the potential of implementing a domestic water conservation and Rainwater Harvesting program in Ireland. The aim was to predict the effect of such a program on per capita consumption rates (PCC) and estimate the potential cost benefit to consumers and producers.

This study assessed the potential water savings from implementing a water demand management strategy incorporating installation of retrofit flow reduction devices in existing dwellings and incorporating water efficiency measures in the design of new dwellings. A modified microcomponent analysis was used to predict PCC values. Table 1 summarises the water efficiency measures considered. Table 2 summarises the predicted water savings.

Water Efficiency Measure
1. A water displacement device to be installed in existing WC's to reduce flows by 1 litre / flush
2. All new houses to be fitted with dual flush 6/4 litre WC's
3. All taps in new houses to be installed with flow limiters
4. All new houses to be fitted with water efficient washing machines (40 l/use) and water efficient dishwashers
5. Rainwater harvesting technology introduced to replace existing demand for WC, clothes washing, waste disposal and garden use of potable mains water

Table 1 Water Efficiency Measures

Efficiency Measure	% Total Reduction in PCC	Household water saving (m^3/yr)
1.Displacement Device	3 %	**4**
2.Dual Flush WC	8 %	**12**
3.Efficient machines	3 %	**5**
4.Tap flow limiters	7 %	**5**
5.Rainwater Harvesting	32 %	**46**

Table 2 Predicted Water Savings

Summary:
The projected PCC for 2018 is 147.17 l/hd/d. The DIT study showed that with no efficiency measures installed, rainwater harvesting has the potential to supply approximately 84% of the mains water demands for wc, clothes washing and garden use, reducing the PCC to 101.27 l/hd/d. If a domestic water conservation program was put in place, incorporating low volume dual flush wc's, rainwater harvesting has the potential to supply 100% of the mains water demand for these activities. This results in a reduced PCC of 82.75 l/hd/d, representing a reduction of 44%, see Fig. 2.

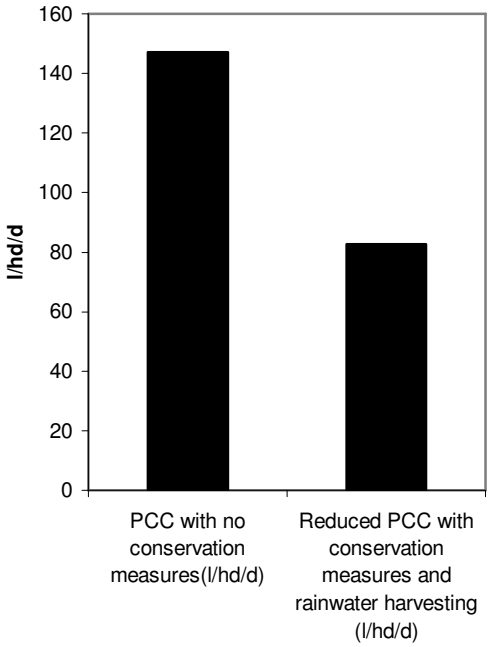

Fig 2. Potential reduction in 2018 PCC

Assuming a domestic charge of €1 / litre the payback time to the consumer is less than two years for WC displacement devices, dual flush toilets and faucet flow limiters. Retrofitting dual flush toilets or installing rainwater harvesting (RH) technology are more expensive and have payback times in excess of 10 years.

Water Conservation / Reuse Strategy for Ireland

The potential for water savings in any new developments in Ireland appears to be self evident. The incorporation of RH systems and dual flush toilets in all new buildings will reduce the quantity of water required per capita. The savings to the producer. i.e the Local Authority or group Scheme are immediate, while those to the consumer may have to await the return of domestic water rates before being an investment that sees a quick return.

There are other reasons for considering RH systems in an Irish context. At present rainwater is a potential resource which is not being used. This was not always so. Most houses, especially in rural areas had barrels and other rainwater collection systems. The Agricultural application of Rainwater Harvesting was widespread throughout the country. The application of this low technology has a history in Ireland and was accepted country wide up until the very recent past. The memory of the technology and its utilisation is widespread.

In rural Ireland the Group water schemes, where small communities have to Design Build and Operate their own potable water schemes provide an excellent and cost effective example of how RH systems could show immediate payback. By reducing household use of treated water the overall bill for water would be reduced.

In urban areas the installation of RH systems would also have a beneficial effect. By collecting the rainwater, surface water runoff volumes could be reduced. This is a sustainable and efficient method of reducing stormwater runoff and relieving pressure on sewerage systems.

PILOT RAINWATER HARVESTING PROJECT

In September, 2004, the Irish Department of Environment, Heritage & Local Government launched a pilot project to examine the potential of rainwater harvesting systems replacing treated mains water, for non-potable uses. Outlining the project Minister Gallagher stated that *'In the case of group scheme Design Build and Operate (DBO) plants, the need to minimise cost, particularly operating cost, has focused attention on the size and capacity of water treatment plants. To be sustainable, the DBO approach must be financially viable and affordable. Unaccounted for water (UFW) is a serious cost to water producers and must be reduced to an absolute minimum. Reducing throughput can minimise volume related charges at the treatment plant. Individual high volume users like dairy farmers can also cut the cost of water by substituting rainwater for use in drinking troughs as well as for yard washing and power hosing. Households too can use rainwater for toilets and outdoor use. Recent advances in the way rainwater is collected and stored makes rainwater harvesting a cost effective and viable option. The collection and reuse of rainwater is an important*

conservation measure and can make a significant contribution to developing a sustainable rural water supply'.

Dr. Tom Collins, Chairperson NRWMC, Pat 'The Cope' Gallagher, Minister of State, Dr. Sean O'Hogain, DIT, Liam McCarton, DIT, Jim Ganley, DOEHLG, at the recent launch of a pilot project to investigate the potential of using rainwater harvesting as an alternative to treated mains water for non-potable uses.

The project leaders are the Department of Civil & Structural Engineering, Dublin Institute of Technology (DIT), in association with the Department of Environment, Heritage & Local Government, the National Rural Water Monitoring Committee and Carlow County Council. The project deals with both the Agricultural and Domestic applications of Rainwater Harvesting (RH).

Agricultural Application

The Agricultural application has been installed on a farm in County Meath. The rainwater from a number of farm buildings is collected, filtered and pumped to storage tanks. It is then fed by gravity to be used for irrigation and water troughs.. A supply line was also constructed to supply sufficient water for barn and yard washings. Flow meters and a weather station have also been installed. These have served to identify existing water use on the farm and will also facilitate accurate measurement of potential water availability and water use.

The quality of the water will also be tested. Tests are conducted monthly for indicator organisms as well as solids, alkalinity and other physico-chemical parameters.

The two year project will develop a water management plan incorporating best practice in water efficiency measures and rainwater harvesting for a farm. It will assess the feasibility of incorporating rainwater harvesting from selected roof areas and will examine methods of treating and storing the rainwater. It will also

develop Guidelines for Sustainable Water Management Systems in Agricultural settings.

Domestic Application

The application of RH to domestic households will be installed on a housing scheme in County Carlow, supplied by a Group Water Scheme. The scheme, consisting of 55 houses, has four different types of house design. Some of the houses will be fitted with rainwater harvesting, some with dual flush WC's and some with no water conservation measures. The rainwater harvesting systems will collect water from roof surfaces only. The rainwater from the downpipe is diverted to a filter manhole that separates solids from the rainwater. The solids are conducted to the surface water drainage system. The harvested rainwater water is diverted to an underground storage tank. Harvested rainwater is pumped into the dwelling to a separate rainwater storage cistern located in the attic. The rainwater is then delivered by gravity to provide water for WC flushing, external garden tap and washing machines only. In periods of low rainfall the rainwater storage cistern is filled from the main water storage cistern by means of a solenoid valve. A tundish type AA air gap will be installed to ensure that no backflow to the mains water supply will occur. All houses in the development will have flow meters fitted. This will allow comparison of water use, measurement of water harvested and water saved due to RH systems and dual flush toilets.

The project will allow the quantity of harvestable rainwater in an Irish location to be calculated. The water savings from rainwater harvesting and water efficiency measures will be determined. This data can then be used to calculate the reduction in per capita demand which can be achieved by the RH system and by the installation of dual flush toilets. This will contribute to the body of knowledge available on Irish Climatic conditions, water use, and sources of water savings in the domestic sector. As with the Agricultural strand of the project, water quality will be monitored as will energy usage and water quality from a rainwater harvesting facility.

Issues surrounding widespread adoption of water reuse /& conservation measures

There are a number of barriers to the widespread acceptance of these conservation measures. There are currently no Irish standards for both rainwater harvesting and water efficient fittings. This absence of design standards has resulted in a widespread reluctance to adopt, use and specify what is perceived as untested technology and equipment in new construction. Similarly there are no Irish standards for the quality of water acceptable for non-potable domestic use.

Financial Payback

Water charges for domestic use in urban areas in Ireland were abolished on January 1st 1997. There are currently no domestic water charges in Ireland. Current government

policy requires local authorities to apply charges to the non domestic sector which reflect the capital and operational costs of supplying water and wastewater services. Currently there are no financial paybacks to the domestic local authority supply consumer from the adoption of water saving devices.

To succeed, a water conservation policy will have to incorporate the following issues:

1. Public Awareness Campaign

Education campaigns to raise public awareness about the need for conservation are critical to the success of a conservation program. This should include postal literature, television and radio advertisements, media coverage, demonstration projects, school curriculums, water audits for specific users and local workshops and training groups.

2. Standards & Legislation

A standards committee should be set up to advise and inform professional bodies on best practice in the area of water conservation and the technologies and designs available. The introduction of legislation to ensure all new developments incorporate water conservation technologies should complement any water conservation program. Legislation such as the Water Framework Directive will force member states to introduce consumer incentives to reduce water consumption.

The pilot projects discussed in this paper are designed to address all of the issues raised and will contribute to Ireland developing a sustainable water demand policy for the next decade.

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