ogc buying.solutions

FINAL WATERMARK PROJECT REPORT

MAY 2003

Reporting Period

1st April 2000 to 31st March 2003

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APPENDICES

Note – As the Appendices consist of over 90 pages, in the interest of paper conservation we have not included them in this version of the report.

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1.0 Executive Summary

1.1   This Final Project Report is a comprehensive summary of activities and results made by OGCbuying.solutions whilst undertaking the Watermark Project.

1.2   The Watermark Project started in April 2000 following a successful funding bid to HM Treasury's Invest to Save Budget (ISB). At that time The Buying Agency (TBA) was responsible for the project, however from 1st April 2001 TBA together with the Managed Services Division of the Central Computer and Telecommunications Agency (CCTA) merged to form a new Executive Agency of the Office of Government Commerce (OGC). This new Agency is now known as OGCbuying.solutions

1.3   At the start of the project in April 2000 a project team was appointed to achieve the projects aims and objectives. Due to internal changes and promotion within OGCbuying.solutions a number of changes were made throughout the 3 year project.

1.4   During April 2000, a steering group was formed to help ensure the project delivered all of its original objectives. This steering group was set up to provide advice and support to the project management team on a regular basis. They formally met on a quarterly basis and received progress reports on a monthly basis. It was always envisaged that from time-to-time steering group representation would change, as the project moved through the various phases of the project plan and to reflect people's own circumstances. A number of changes in membership took place throughout the duration of the project.

1.5   The first task when the project started was to draw up a project specification in the form of a Project Initiation Document (PID). This gave background information about the project as well as setting out what the project was to achieve.

1.6   The full list of aims and objectives and results is provided in the table below:

PID No.	Project Aims	Has it been met?	Comments
2.1	To implement, and prove the viability of a water monitoring database with a number of public sector sites.	Yes	Over 3200 sites have been registered on the database.
2.1	To use the data inputted into the database to set benchmarks and provide targets for improvement.	Yes	Benchmarks have been set for 17 building categories that account for approximately 80% of the public sector estate. The findings of the project are to be passed to DEFRA for target setting in Central Government.
2.1	To promote the reduction of water consumption within the public sector estate and to secure the ensuing financial and environment benefits.	Yes	The project has raised the profile of water conservation in the public sector.
2.1	To provide valid data to Government that will enable the negotiation of competitive charges with water and sewerage providers, as far as the state of the market will allow.	No	The market has not opened sufficiently for competition as yet. Data has been provided to the Water Competition branch of Defra for inclusion into forthcoming legislation.
Specific Objectives			
2.2.1	Identify an average water consumption m^3/person/per annum/type of facility) amongst the participating departments. This will be known as the benchmark or current practice applicable for the public sector.	Yes	Benchmarks have been set for 17 building categories that account for approximately 80% of the public sector estate.
2.2.2	Creation of an energy performance table for water, water used and surface water, amongst participating departments resulting in target performance indicators.	Yes	Data on surface water was not available. The Project completed study energy and CO_2 implications for the delivery and treatment of water.

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2.2.3	Achieve a 10% or greater identification of reduction in water consumption and costs amongst participating departments at the end of the pilot phase of the project.	Yes	It is estimated that the annual water bill for the public sector is £600 million. The project has highlighted a potential save in excess of £140 million.
2.2.4	Produce a standard format for reporting water related costs and consumption that will enable the development and refining of effective benchmarks and performance indicators.	Yes	All benchmark reports are of a standard format.
2.2.5	Commence and complete pilot evaluation of the project within nominated departments and report recommendation for improvement.	Yes	Studies and benchmark reports have been issued to Central Government Departments.
2.2.6	Acquire a relational database system for the management of required data which is compatible with existing government IS standards and which will permit effective interrogation and reporting of performance between facilities/buildings and aggregation of data by departments and agencies.	Yes	All data on the project is held in a Microsoft Access database. Data is also collectable by a web-based database.
2.2.7	Produce a full report on water consumption in the public sector amongst participating departments.	Yes	Final project report to be distributed to all participants.
2.2.8	Following successful piloting, tender and appoint trade monitoring and targeting software companies to roll out the scheme to the rest of the public sector.	Yes	An interactive tool is available on the project website for establishments to gauge performance against the established benchmarks A range of services is available for the public sector to use.
2.2.9	Establish and test during the pilot phase, the viability and practicability of the self-financing scheme.	Yes	A range of services have been piloted and introduced to enable the project to be self-financing.
2.2.10	Provide a case study of best practice in the public sector for promotion by Energy Efficiency Best Practice Programme (EEBPP) now Action Energy to the private sector.	Yes	Several case studies have been written and published.
2.2.11	Establish an Internet web site on benchmarking and target performance setting.	Yes	The project has set its website up at www.watermark.gov.uk
2.2.12	Provide tariff reductions with the water and sewage industry for the benefit of participation departments within the scheme.	No	The water supply industry has not opened up to competition. Data has been provided to the Water Competition branch of Defra for inclusion into forthcoming legislation.

1.7   An initial high level project plan based upon the PID was assembled during April 2000. This initial plan was set over a 2-year duration and was reviewed for progress at regular intervals. The plan was expanded to 3 years, after a project review and authorisation by HM Treasury ISB Unit. Tasks remained the same but the durations were increased.

1.8   The Project Leader carried out three major project reviews throughout the duration of the project. The conclusions of these reviews resulted in major changes to the project direction and operation.

1.9   A range of marketing initiatives took place ranging from placement of magazine articles, formal presentations to interested parties, to considerable mailings of the project information. In all approximately 10,000 mailings were sent to various organisations.

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1.10   The water bill validation service proved to be very successful. The table below shows the results obtained from the
        water bill validation exercise carried out for participants who requested this service during the project.

Total number of bills validated	986
Percentage incorrect	2%
Total value of monies credited	£54,691
Annual charge if these errors had gone un-noticed (errors would have been repeated throughout the year)	£287,328

1.11   As the benchmarking analysis was completed the potential saving figures were calculated based on an estimated
        number of sites in each of the building classifications. If all sites within each of the building classifications were to
        achieve or better the recommended typical benchmark then there is a total potential save of £140.2 million.

1.12   A total of 57 water reduction surveys were carried out. The result of these savings outlined that if specific
        measures were implemented then a total of 377,000 cubic metres of water could be saved. Investment required for
        this saving to be achieved yielded an average payback of 11 months.

1.13   A number of organisations decided to implement findings of water reduction surveys. In all 5 organisations
        implemented water saving measures. To date these organisations have saved 70,802 cubic metres of water that
        equates to approximately £81,000. A further case study carried out within the Prison Service has yielded estimated
        savings of £60,000; detailed information was not available at the time of publication of this report.

1.14   Benchmarks for 17 building categories were established and are listed in the table below:

Building Category	Recommended typical benchmark
Office	9.3 m^3/person/annum
Prison with laundry	143 m^3/prisoner/annum
Prison without laundry	116.6 m^3/prisoner/annum
Primary school with pool	4.3 m^3/pupil/annum
Primary school without pool	3.8 m^2/pupil/annum
Secondary school with pool	5.1 m^3/pupil/annum
Secondary school without pool	3.9 m^3/pupil/annum
DEFRA laboratory	0.767 m^3/sq. metre floor area/annum
Large acute or teaching hospital	1.66 m^3/sq. metre floor area/annum
Small acute or long stay hospital without personal laundry	1.17 m^3/sq. metre floor area/annum
Small acute or long stay hospital with personal laundry	1.56 m^3/sq. metre floor area/annum
For all hospitals with central laundry facilities	Add 8.2 litres per laundry article process per annum
Court with catering facilities	0.54 m^3/sq. metre floor area/annum
Court without catering facilities	0.25 m^3/sq. metre floor area/annum
Museum and Art Gallery	0.332 m^3/sq. metre floor area/annum
Nursing Home	80.6 m^3/resident/annum
College and University	0.62 m^3/sq. metre floor area/annum
Public Lavatory	10.7 m^3/sq. metre floor area/annum
Police Station	0.92 m^3/sq. metre floor area/annum
Sports Centre	0.0385 m^3/visitor/annum
Library	0.203 m^3/sq. metre floor area/annum
Community Centre	0.326 m^3/sq. metre floor area/annum
Fire Station	15.08 m^3/person/annum
Coastguard Station	12.62 m^3/person/annum
Vehicle Inspectorate Depot	0.12 m^3/sq. metre floor area/annum

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1.15   During December 2000 an initial Watermark website was launched giving people basic information about the project. An on-line questionnaire was added at a later date. During June 2002 a major overhaul and redevelopment of the website was undertaken. The new website moved away from the previous "online brochure" format to a database driven site complete with a content management module so that OGCbuying.solutions could control content in a more efficient manner. An editorial team was set up to populate and update the website. An interactive tool has been also added so that organisations can measure relative performance against the established benchmarks. All data is now captured on this new website.

1.16   A reliable method of assessing savings by benchmarking has previously been developed through the UK Government's Energy Efficiency Best Practice Programme (EEBPP – now Action Energy). This model is used in a large number of published Energy Consumption and Good Practice Guides. The same benchmarking rationale has been applied to water consumption benchmarking for the Watermark Project. From initial analysis carried out on data submitted it soon became apparent that the methodology produced skewed results. Advice was taken from the Department for Education and Skills (DfES) Analytical Services Division on how they approached benchmarking within schools and how we could adopt a common approach. DfES stated that the methodology adopted by the project was sound and appropriate. However, because skewed bell curves were being calculated then it was more appropriate to use the median as the typical benchmark.

1.17   A report was prepared for OGCbuying.solutions by Building Research Establishment (BRE) to enable the impact of water efficiency measures on CO_2 emissions to be determined. This study focussed on CO_2 emitted for the supply of water and the treatment of wastewater only and did not include domestic water heating. The report concluded that the national average of energy use and CO_2 emissions in 1998/99 for the supply of water and the treatment of wastewater were:

468 kWh per megalitre of water supplied producing 209 kg of CO_2
437 kWh per megalitre of wastewater treated producing 195 kg of CO_2

1.18   A range of additional services has been made available via the Watermark main contractor Advanced Demand Side Management (Adsm plc). These consist of a subscription scheme for water bill validation and monitoring and targeting reports, water reduction surveys and capital works and also a Water Services Contract. The main features of the Water Services Contract is that Adsm plc will install and maintain a range of water saving measures in return for a share of the saving made. This allows any departments (public sector organisations) with no budget to initiate savings.

1.19   One of the main project observations is that water is the forgotten utility and few organisations are taking water conservation seriously. Few organisations do not have in-depth water data on their own estate nor are they monitoring basic site details.

1.20   Water conservation is fairly straightforward, with major quick wins in the region of 15~20% of annual water bill available. Payback on investments made during the project was usually within 12 months.

1.21   Recommendations for further work have been included in this report.

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2.0 Introduction

2.1   This Final Project Report is a concise and informative report on the activities and results made by OGCbuying.solutions, in their goal of meeting the main objectives of the watermark project.

2.2   The Watermark Project started in April 2000 following a successful funding bid to HM Treasury's Invest to Save Budget (ISB). At that time The Buying Agency (TBA) was responsible for the project, however from 1ˢᵗ April 2001 TBA together with the Managed Services Division of the Central Computer and Telecommunications Agency (CCTA) merged to form a new Executive Agency of the Office of Government Commerce (OGC). This new Agency is now known as OGCbuying.solutions

2.3   This report is structured in such a format to include significant detail relating to the Watermark operation, including the processes involved through participation. It concentrates on all activities and results achieved during the three year project duration.

2.4   Appendices are not included, due to their being over 90 pages.

3.0 Management Structure

3.1   In order to achieve the projects aims and objectives, a project team was appointed; consisting of the names below:

Jim Parkinson   -   Head of OGCenergy
Neil Kitchen   -   Project Leader
Elaine Rooney   -   Project Manager
Patricia Dunne   -   Project Officer
Matthew Grek   -   Communications Executive
Leila Naghashi   -   Project Officer - Joined the project March 2002

3.2   An initial steering group was formed to help ensure the project delivered all of its original objectives. This steering group provided advice and support to the project management team on a regular basis. They formally met on a quarterly basis and received progress reports on a monthly basis.

3.3   It was always envisaged that from time-to-time steering group representation would change, as the project moved through the various phases of the project plan and to reflect people's own circumstances. Benjamin Dent and Roger Hinds, both of DEFRA and Vijay Puri DfES have now moved to other positions within there respective organisations and have therefore resigned from the Project Steering Group prior to project completion.

3.4   At the end of the project the steering group consisted of the following key personnel:

Dave Hill, ODPM
Rob Mynard, DEFRA
Dave Howarth, Environment Agency,
Louise Burge, OGC
Dean Bridge, OFWAT
Steve Hodges, North Somerset Council
Richard Daniels, DfES
Andrew Charlesworth-May, DfES
Bill McNulty, North East Purchasing Organisation (NEPO)

4.0 Project Methodology

4.1   The first task when the project started was to draw up a project specification in the form of a Project Initiation Document (PID). This gave background information about the project as well as setting out what the project was to achieve.

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4.2 Project Plan

An initial high level project plan based upon the PID was assembled during April 2000. This initial plan was set over a 2-year duration and was reviewed for progress at regular intervals. The plan was expanded to 3 years, after a project review and authorisation by HM Treasury ISB Unit. Tasks remained the same but the durations were increased or slipped.

Main Project Task	DATE
Appointment of initial TBA resource	April 2000
Project evaluation	April 2000
Assemble project sponsor/steering group	May~June 2000
Appointment of TBA resource	June 2000
Marketing Activity – identify participants	April~Sept 2000
Place EC advert & evaluate responses	May 2000
Develop internal website	July 2000
Tender evaluation	July~Aug 2000
On-going marketing activity	Oct 00~July 01
Award of contract	September 2000
Development & configuration of software	Sept~Oct 2000
Data load of retrospective data assembled	November 2000
Establishment of initial benchmark	December 2000
Data load 2	July 2001
Review of benchmarks	July 2001
On-going of marketing activity	July~Dec 2001
Development of user website	August 2001
Data load 3	December 2001
Review of benchmarks	December 2001
Establish on-going ideas for future project developments	February 2002
Marketing future project ideas & developments	February 2002
Final data load	March 2002
Establish final benchmark	March 2002
Deliver project conclusions& publish final report	March 2002

4.3 Project Reviews

As in all projects, the Watermark Project was constantly reviewed on a monthly basis with minor adjustments made to strategy and operational activities. However three major project reviews were held which implemented major changes to the project direction and operation.

4.3.1   Review 1 – April 2001

4.3.1.1 This review concentrated on data collection.

4.3.1.2 The project had been running for 12 months, with the collection of data from participating departments and local authorities commencing in earnest during January 2001, with over 1,000 questionnaires distributed up to March 2001. It was at this stage in the project that it became apparent many organisations were finding it difficult to return site-specific questionnaires together with billing information. At this point we realised the project would take much longer than expected to achieve its objectives. In an attempt to resolve data collection issues, we interviewed a number of participants who generally expressed the desire for a short questionnaire. A plan was quickly put in place, with trial one-page questionnaires for schools being piloted in a number of Local Authorities.

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4.3.1.3   Therefore the review made several recommendations that were subsequently adopted:

- Reduce all questionnaires significantly – to one page.
- Invest more resource in case studies, to help market the potential of the project.
- Approach ISB to consider an extension to the project. This was formally accepted with funding granted to April 2003.
- Configure the website to offer "On-Line" questionnaires.

4.3.2   Review 2 – January 2002

4.3.2.1   This review concentrated on the following aspects such as:

Software
Relative success of achieving benchmarks
Marketing of the project
Service offering

4.3.2.2   The review concluded that:

- The present interactive software modified by the contractor was not good enough. Demand for access to this software had been very low and therefore it was decided to channel effort into further development of the watermark website.
- The website had been very successful with a large volume of traffic accessing it every month. It was decided to totally revise this website both in look and functionality and expand it to include several interactive tools.
- Gaining data for the project had been extremely slow, a strategy and plan to collate data to establish the remaining benchmarks was required.
- Marketing of the project had been effective in obtaining initial interest with a wide variety of organisations expressing an interest in the project. Converting interest into participation had proved more difficult.
- The service offered to potential participants was considered good with no need for change. The marketing of the service offered needed to be more specific.

4.3.2.3   The result of the review concluded that the present contractors abilities did not meet with the projects objectives.

4.3.2.4   Adsm plc was appointed as the new Watermark contractor with effect 1st April 2002. It was felt that they were a very pro-active organisation that has the range of skills to analyse data, establish benchmarks and aid organisations to reduce their water consumption.

4.3.3   Review 3 – January 2003

4.3.3.1   With only 3 months of the project outstanding this final review concentrated on data held, overall results and objectives for the remaining duration of the project

4.3.3.2   The review concluded that:

- Benchmarks had been established or were being calculated for 8 building categories
- A further 8 building categories had significant data and should be given priority in data collection
- It was clear that all building categories would not achieve benchmarks due to lack of data however a strategy was required to collect outstanding data.

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4.3.3.3   It was decided to target the following building categories:

Library
Museum
Community Centre
Sports Centre
Golf Course
Police Station
Fire Station
Nursing Home

4.3.3.4   The following course of action was taken:

- **Local Authorities**
    - o   Libraries, Community Centres and Sports Centre fell into this category
    - o   We had consumption data from a number of local authorities already
    - o   Carry out research for a range of buildings via website
    - o   Call individual sites to fill in missing details.

- **Museums**
    - o   Carry out further mail shot and follow up to obtain numbers
    - o   1100 letters were sent to museums, it is believed this is the total number of this building category in the UK

- **Golf Courses**
    - o   A further mail shot took place to 150 establishments; in all 1000 golf courses have been sent questionnaire requesting information. A follow up to take place

- **Police Stations**
    - o   Chase up missing data on Greater Manchester Police
    - o   Contact 8 police forces that have already submitted data – ask for 5 more police stations from each force.
    - o   Mail shot all forces that failed to respond
    - o   Contact Northampton Police who are carrying out a similar exercise.

- **Fire Service**
    - o   Mail shot all brigades that failed to respond to initial mail shot during 2002
    - o   Contact fire brigades that have submitted data and ask for more

- **Nursing Homes**
    - o   Mail shot a further 1000 nursing homes for data. This brought the total number of nursing homes approached to 2000.

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4.4 Marketing

4.4.1 A range of marketing initiatives took place in order to achieve the project's objectives. The majority of information was collated either by the website or from existing contact lists in regards to the mail merges (Refer to the table below). In addition to this we held a number of Local Authorities Forums around the country as well as presentations and articles in magazines.
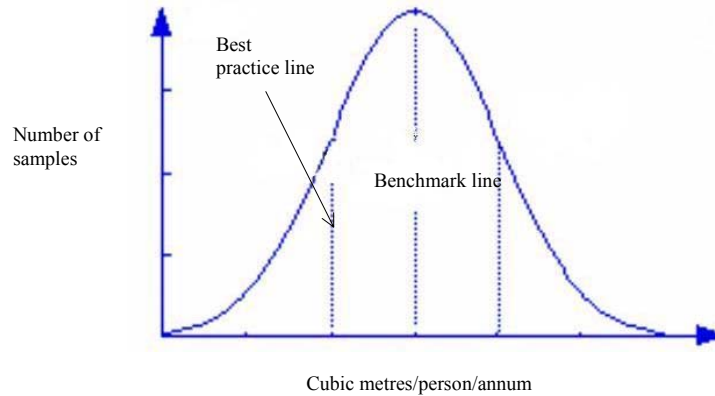
Colleges
219 Letters sent to contacts
15 Questionnaires received by Watermark
12 Questionnaires had complete data and were analysed by Adsm plc

Universities
93 Letters sent to contacts
10 Questionnaires received by Watermark
2 Questionnaires had complete data and were analysed by Adsm plc

Nursing Homes
2029 Letters sent to contacts
58 Questionnaires received by Watermark
49 Questionnaires had complete data and were analysed by Adsm plc

Fire Service
60 Letters sent to contacts
47 Sites Received by Watermark
47 Sites had complete data and were analysed by Adsm plc

Golf Clubs
1029 Letters sent to contacts
62 Questionnaires received by Watermark
27 Questionnaires had complete data and were analysed by Adsm plc

Museums
807 Letters sent to contacts
75 Questionnaires received by Watermark
42 Questionnaires had complete data and were analysed by Adsm plc

Art Galleries
317 Letters sent to contacts
33 Questionnaires received by Watermark
17 Questionnaires had complete data and were analysed by Adsm plc

Police
114 Letters sent to contacts
7 Forces returned questionnaires to Watermark
7 Forces had complete data and were analysed by Adsm plc

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5.0 Benchmarking Techniques

5.1 The Benchmarking Model

5.1.1   Following initial analysis using the average or mean of the dataset as the benchmark, it soon became apparent that the methodology used produced skewed results. Advice was taken from the Department for Education and Skills (DfES) Analytical Services Division on how they approached benchmarking within schools and how we could adopt a common approach. DfES stated that the methodology adopted by the project was sound and appropriate. However, because skewed bell curves were being calculated it was more appropriate to use the median as the typical benchmark. This is the approach the DfES are adopting in their own benchmarking work. The following paragraphs outline the change to the benchmarking methodology. The statistical techniques involved remain the same.

5.1.2   A reliable method of assessing savings by benchmarking has previously been developed through the UK Government's Energy Efficiency Best Practice Programme (EEBPP). This model is used in a large number of published Energy Consumption and Good Practice Guides. The same benchmarking rationale has been applied to water consumption for the Watermark Project.

5.1.3   The aim of water benchmarking is to produce a consumption figure for different buildings/establishments based upon comparisons with other similar sites. As every establishment is likely to be different, variables such as occupancy numbers, duration of use and the type of activity undertaken within the building/establishment must be taken into account. The detailed Watermark questionnaires were designed to identify a number of variations between buildings/establishments.

5.1.4   A range of statistical techniques has been adopted to ensure that when comparing different establishments we arrive with a like-for-like analysis. These techniques are described within 5.2 of this report. However, even after taking into account many significant causes of difference in consumption, we are still left with a range of establishments with differing patterns of consumption. Generally, there will be a range of different consumer patterns from low to high consumption. It is this spread of consumption patterns, that when analysed, indicates where there is potential for savings.

5.1.5   A specific consumption figure is calculated for each establishment within a dataset. Typically, consumption per square metre of floor area or consumption per occupant could be used and this would then be subject to ranking. The median of the entire dataset is taken as a **"typical"** benchmark. The specific consumption of half of the sites will be above this figure and half will be below. On publication of a benchmark, establishments will be able to determine how well they are performing, using the methodology provided. This method will provide quick and simple results, enabling establishments to determine whether there is cause for concern.

5.1.6   A **"best practice"** benchmark is calculated by taking the first quartile line of the dataset. A quarter of the sites in the dataset will have specific consumptions less than the first quartile. The assumption is that if all establishments in the sector adopted a range of water saving measures, the "typical" specific consumption figure would be reduced to this "best practice" level. A total potential saving can then be calculated based upon all of the establishments in the dataset reducing their consumption to the "best practice" level. It should be noted that all published "best practice" benchmarks would have already been achieved by a number of establishments within the dataset.

A typical graphical representation is shown below. This pictorial representation is a standard normal distribution curve and does not show the skewed effects.

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Number of samples

Best practice line

Benchmark line

Cubic metres/person/annum

5.2 Statistical Techniques Used

5.2.1   Specific Consumption - The water consumption benchmark for a building/establishment is expressed as a specific consumption. This is the total annual water consumption divided by a factor appropriate to the building/establishment type. This allows the water consumption for different sites to be compared.

5.2.2   The type of activity carried out within a building/establishment will also determine the choice of factors. For example, a school or prison may divide consumption by the number of permanent occupants (i.e. pupils or prisoners), while a museum or library may utilise other drivers such as visitor numbers or the number of books taken on loan in a given period.

5.2.3   Bell Curve - The bell curve graph provides a simple visual indication of the spread between high and low specific consumptions.

5.2.4   Where at least 50 sites of a particular type have been collected, these sites are grouped into "buckets" of say 0 to 1, 1 to 2, 2 to 3 cubic metres per annum against specific consumption, with a graph drawn of the number of sites in each "bucket". Normally we expect to see a bell-shaped curve with one peak around the mean average specific consumption for the dataset of sites.

5.2.5   If there are two or more distinct peaks, then the sites may need dividing up into two or more distinct groups based on the information in the questionnaires.

5.2.6   Student's T-test - The Student's T-test measures the significance of the difference between two samples of values. It gives the probability that the difference could have arisen by chance, and if the probability was below say 5% then we could conclude that the criterion on which the samples were selected is significant in determining the values. Use of the T-test assumes that the two samples have a distribution, which approximates to the bell curve or normal distribution. During the various analysis carried out on a data sample was tested for normal distribution before the application of the T-test.

5.2.7   Using this method, the sites are divided into two or more groups based on the answers to a yes/no or multi-option question in the Watermark questionnaire. The specific consumptions of pairs of groups are then compared using the T-test. The result will depend on the difference between the average specific consumption of the groups, the scatter (variance) within each group, and the number of sites in each group.

5.2.8   If the test shows a high significance (i.e. a low probability that the difference in specific consumption could have arisen by chance) then we may conclude that the groups should be given separate benchmarks.

5.2.9   Regression and Correlation Coefficient - This technique relates water consumption to a numerical driver on the Watermark questionnaire that is likely to be different for each site. Drivers such as floor area, or number of hours of purposeful activity in a prison may provide statistical relationships between water consumption. This technique is applied after the data has been subdivided into groups using the T-test.

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5.2.10 The technique is to plot an X-Y graph of the specific consumption vs. the driver, and find the best-fitting line through the points. The line is expressed as a "$y=mx+c$" equation where c is the specific consumption when the driver is zero while m is the increase in specific consumption for an increase of 1 in the driver.

5.2.11 The correlation coefficient shows what proportion of the variation in specific consumption is associated with the variation in the driver. A correlation coefficient of 1 or -1 means the points are all on the straight line, while zero indicates a totally random scatter. This can also be converted into a significance value that gives the probability that any observed correlation might have arisen by chance.

6.0 Results

6.1 Project Aims

6.1.1 Ultimately all projects are judged on whether they are successful or not and whether they meet their initial objectives or deliverables. Below is a table with the aims and objectives as set out in the PID. The table states whether each aim or objective has been met and provides comments to support the success or why the objective has not been met.

PID No.	Project Aims	Has it been met	Comments
2.1	To implement, and prove the viability of a water monitoring database with a number of public sector sites.	Yes	Over 3200 sites have been registered on the database.
2.1	To use the data inputted into the database to set benchmarks and provide targets for improvement.	Yes	Benchmarks have been set for 17 building categories that account for approximately 80% of the public sector estate. The findings of the project are to be passed onto DEFRA for target setting in Central Government.
2.1	To promote the reduction of water consumption within the public sector estate and to secure the ensuing financial and environment benefits.	Yes	The project has raised the profile of water conservation in the public sector.
2.1	To provide valid data to Government that will enable the negotiation of competitive charges with water and sewerage providers, as far as the state of the market will allow.	No	As yet the market has not opened sufficiently for competition. Data has been provided to the Water Competition branch of Defra for inclusion into forthcoming legislation.
Specific Objectives			
2.2.1	Identify an average water consumption m3/person/per annum/type of facility) amongst the participating departments. This will be known as the benchmark or current practice applicable for the public sector.	Yes	Benchmarks have been set for 17 building categories that account for approximately 80% of the public sector estate.
2.2.2	Creation of an energy performance table for water, water used and surface water, amongst participating departments resulting in target performance indicators.	Yes	Data on surface water was not available. The Project completed study energy and CO^2 implications for the delivery and treatment of water.
2.2.3	Achieve a 10% or greater identification of reduction in water consumption and costs amongst participating departments at the end of the pilot phase of the project.	Yes	It is estimated that the annual water bill for the public sector is £600 million. The project has highlighted a potential save in excess of £140 million.
2.2.4	Produce a standard format for reporting water related costs and consumption that will enable the development and refining of effective benchmarks and performance indicators.	Yes	All benchmark reports are of a standard format.

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2.2.5	Commence and complete pilot evaluation of the project within nominated departments and report recommendation for improvement.	Yes	Studies and benchmark reports have been issued to central Government Departments.
2.2.6	Acquire a relational database system for the management of required data which is compatible with existing government IS standards and which will permit effective interrogation and reporting of performance between facilities/buildings and aggregation of data by departments and agencies.	Yes	All data on the project is held in a Microsoft Access database. Data is also collectable by a web based database
2.2.7	Produce a full report on water consumption in the public sector amongst participation departments.	Yes	Final project report to be distributed to all participants
2.2.8	Following successful piloting, tender and appoint trade monitoring and targeting software companies to roll out the scheme to the rest of the public sector.	Yes	An interactive tool is available on the project website for establishments to gauge performance against the established benchmarks. A range of services is available for the public sector to use.
2.2.9	Establish and test during the pilot phase, the viability and practicability of the self-financing scheme.	Yes	A range of services have been piloted and introduced to enable the project undertaken self-financing
2.2.10	Provide a case study of best practice in the public sector for promotion by Energy Efficiency Best Practice Programme (EEBPP) now Action Energy to the private sector.	Yes	Several case studies have been written and published.
2.2.11	Establish an Internet web site on benchmarking and target performance setting.	Yes	The project has set its website up at www.watermark.gov.uk
2.2.12	Provide tariff reductions with the water and sewage industry for the benefit of participation departments within the scheme.	No	The water supply industry has not opened up to competition. Data has been provided to the Water Competition branch of Defra for inclusion into forthcoming legislation.

6.2 Bill Validation

6.2.1   As part of watermark's free Monitoring and Targeting (M&T) services offered to participating organisations, if requested all water bills submitted were validated for correctness. If any billing errors are found in favour of the participant, then the water supplier was contacted by the Watermark contractor to seek refunds. All bill validation refunds went straight back to the participant.

6.2.2   The bill validation service proved to be very successful. The table below shows the results obtained from the bill validation exercise carried out for participants who requested this service during the project.

Total number of bills validated	986
Percentage incorrect	2%
Total value of monies credited	£54,691
Estimated Annual charge if errors had gone un-noticed (errors would have been repeated throughout the year)	£287,328

6.2.3   A number of different types of error were found:

Wrong tariffs applied
Wrong account number and site name
Incorrect totals
Meter readings that do not follow on from previous readings
Duplicate bills

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Rateable values incorrectly levied
Incorrect standing charges applied

6.3 Resultant Benchmarks

Sector – Prisons (UK Mainland) **Number of prisons used for analysis = 144**
The typical benchmarks for prison establishments based on the dataset provided are as follows: **All Prisons**   **– 123.5 m³/prisoner/annum**   **Prisons with laundries**   **– 143.0 m³/prisoner/annum**   **Prisons without laundries – 116.6 m³/prisoner/annum**   The resultant "best practice" benchmarks for prison establishments based on the dataset provided are as follows: **All Prisons**   **– 96.0   m³/prisoner/annum**   **Prisons with laundries**   **–115.3   m³/prisoner/annum**   **Prisons without laundries – 92.4   m³/prisoner/annum**

Sector – Schools (England) **Number of Schools used for analysis – 14,330**
The resultant typical benchmarks for the schools sector based on the dataset provided are as follows: **Primary School with pool**   **- 4.3 m³/pupil/annum.**   **Primary School without pool**   **- 3.8 m³/pupil/annum**   **Secondary School with pool**   **- 5.1 m³/pupil/annum**   **Secondary School without pool**   **- 3.9 m³/pupil/annum**   The resultant "best practice" benchmarks for Schools based on the dataset provided are as follows: **Primary School with pool**   **- 3.1 m³/pupil/annum.**   **Primary School without pool**   **- 2.7 m³/pupil/annum**   **Secondary School with pool**   **- 3.6 m³/pupil/annum**   **Secondary School without pool**   **- 2.7 m³/pupil/annum**

Sector – Offices **Number of offices used for analysis – 500**
The resultant typical benchmarks for office establishments based on the dataset provided are as follows: **9.3 m³/person/annum**   The resultant "best practice" benchmarks for office establishments based on the dataset provided are as follows: **6.4 m³/person/annum**

Sector – DEFRA Laboratories **Number of laboratories used for analysis - 14**
The resultant typical benchmarks for DEFRA Laboratory establishments based on the dataset provided are as follows: **0.767 m³/sq. metre floor area/annum**   The resultant "best practice" benchmarks for DEFRA Laboratory establishments based on the dataset provided are as follows: **0.612 m³/sq. metre floor area/annum**

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Sector – Hospitals
Number of Hospital used for analysis – 273

The resultant typical benchmarks for Hospital establishments based on the dataset provided are as follows:
- **Large acute or teaching hospital – 1.66 m^3/sq. metre floor area/annum**
- **Small acute or long stay hospital without personal laundry facility – 1.17 m^3/sq. metre floor area/annum**
- **Small acute or long stay hospital with personal laundry facility – 1.56 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for Hospital establishments based on the dataset provided are as follows:
- **Large acute or teaching hospital – 1.38 m^3/sq. metre floor area/annum**
- **Small acute or long stay hospital without personal laundry facility – 0.90 m^3/sq. metre floor area/annum**
- **Small acute or long stay hospital with personal laundry facility – 1.24 m^3/sq. metre floor area/annum**

For hospitals with central laundry facilities, **add 8.2 litres per laundry article** processed per annum

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Sector – Courts
Number of Courts used for analysis - 44

The resultant typical benchmarks for Court establishments based on the dataset provided are as follows:
- **Courts with catering facilities   - 0.54 m^3/sq. metre floor area/annum**
- **Courts without catering facilities – 0.25 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for courts establishments based on the dataset provided are as follows:

- **Courts with catering facilities   - 0.35 m^3/sq. metre floor area/annum**
- **Courts without catering facilities – 0.20 m^3/sq. metre floor area/annum**

Sector – Museums
Number of Museums used for analysis - 50

The resultant typical benchmarks for Museum establishments based on the dataset provided are as follows:
- **0.332 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for Museum establishments based on the dataset provided are as follows:
- **0.181 m^3/sq. metre floor area/annum**

Sector – Nursing Homes
Number of Nursing Homes used for analysis - 70

The resultant typical benchmarks for Nursing Home establishments based on the dataset provided are as follows:
- **80.6 m^3/resident/annum**

The resultant "best practice" benchmarks for Nursing Home establishments based on the dataset provided are as follows:
- **68.5 m^3/resident/annum**

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Sector – Higher & Further Education
Number of sites used for analysis - 127

The resultant typical benchmarks for Higher & Further Education establishments based on the dataset provided are as follows:

- **0.62 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for Higher & Further Education establishments based on the dataset provided are as follows:

- **0.40 m^3/sq. metre floor area/annum**

Sector – Public Lavatories
Number of sites used for analysis - 86

The resultant typical benchmarks for Public Lavatories establishments based on the dataset provided are as follows:

- **10.7 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for Public Lavatories establishments based on the dataset provided are as follows:

- **6.0 m^3/sq. metre floor area/annum**

Sector – Police Stations
Number of sites used for analysis - 141

The resultant typical benchmarks for Police Stations based on the dataset provided are as follows:

- **0.92 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for Police Stations based on the dataset provided are as follows:

- **0.63 m^3/sq. metre floor area/annum**

Sector – Sports Centres
Number of sites used for analysis - 65

The resultant typical benchmarks for Sports Centres based on the dataset provided are as follows:

- **0.0385 m^3/visitor/annum**

The resultant "best practice" benchmarks for Sports Centres based on the dataset provided are as follows:

- **0.0305 m^3/visitor/annum**

Sector – Libraries
Number of sites used for analysis - 89

The resultant typical benchmarks for libraries based on the dataset provided are as follows:

- **0.203 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for libraries based on the dataset provided are as follows:

- **0.128 m^3/sq. metre floor area/annum**

Sector – Community Centres
Number of sites used for analysis - 62

The resultant typical benchmarks for Community Centres based on the dataset provided are as follows:

- **0.326 m^3/sq. metre floor area/annum**

The resultant "best practice" benchmarks for Community Centres based on the dataset provided are as follows:

- **0.173 m^3/sq. metre floor area/annum**

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Sector – Fire	
Number of sites used for analysis - 61	
The resultant typical benchmarks for Fire Stations based on the dataset provided are as follows: • **15.08 m³/person/annum** The resultant "best practice" benchmarks for Fire Stations based on the dataset provided are as follows: • **9.38 m³/person/annum**	

Sector – Maritime and Coastguard Agency **Number of sites used for analysis - 116**
No benchmarks could be recommended for this organisation although a figure of 12.62 m²/person/annum could be used as guidance only for coastguard stations.

Sector – Depots **Number of sites used for analysis - 23**
No benchmarks could be calculated in this sector as no correlations were found in the data set provided. More data is required.

Sector – Golf Courses **Number of sites used for analysis - 45**
No benchmarks could be calculated in this sector as no correlations were found in the data set provided. More data is required.

Sector – Vehicle Inspectorate Agency **Number of sites used for analysis - 71**
The resultant typical benchmarks for Vehicle Inspection Stations based on the dataset provided are as follows: • **0.12 m³/sq. metre floor area/annum** Due to the small sample size good practice benchmarks were not calculated.

6.4 Actual Savings

6.4.1   The benchmarks established help organisations measure their relative performance and to judge whether improvements could be made. This is excellent, however organisations do need to do something practical to reduce their consumption. The project took the view that ranges of additional services were required from our main contractor Adsm plc if organisations were able to reap the benefit of these established benchmarks. A Water Services Contract (WSC) was introduced and made available to all public sector organisations.

6.4.2   Below are details of actual savings made by organisations to the end of February 2003.

Organisation	Derby University
No. of buildings	5
Building Type	University
Joined scheme	Rolling program started November 2001
Savings to date m³	45,118
Savings to date £	54,010

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Organisation	Department for Education & Skills (DfES)
No. of buildings	6
Building Type	Office
Joined scheme	September 2002
Savings to date m^3	4,376
Savings to date £	5,093

Organisation	COI Communications
No. of buildings	1
Building Type	Office
Joined scheme	November 2002
Savings to date m^3	426
Savings to date £	450

Organisation	Langley Grammar School
No. of buildings	1
Building Type	School
Joined scheme	November 2002
Savings to date m^3	104
Savings to date £	110

Organisation	HM Treasury
No. of buildings	1
Building Type	Office
Joined scheme	February 2001 to August 2002 = 18 months
Savings to date m^3	20,778
Savings to date £	21,768 = 56% of initial water bill

Organisation	Parkhurst Prison
No. of buildings	1
Building Type	Prison
Joined scheme	July 2001
Savings to date m^3	Awaiting data from HM Prison Service
Savings to date £	60,000 – 30% of annual water bill (estimate)

Total savings to date m^3	**70,802**
Total savings to date £	**141,431**

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6.5 Potential Savings

6.5.1   Data Analysis – Potential Savings Identified

Based on the results of the established initial benchmarks the following potential savings have been identified.

Sector – Prisons (UK Mainland)   **Number of prisons used for analysis – 144**
From the dataset provided, given that if all prison establishments in the data set were to achieve or better the typical benchmark, then approximately 1,600,000 cubic metres of water per annum could be saved.   There are 158 prison establishments within the UK; therefore the total potential save for HM Prison estate is 1,755,556 cubic metres of water.

Sector – Schools (England)   **Number of Schools used for analysis - 390**
From the dataset provided, given that if all school establishments in the data set were to achieve or better the typical benchmark, then approximately 197,506 cubic metres of water per annum could be saved.   There are approximately 33,000 schools within the UK; therefore the total potential save for the school estate is 17,500,000 cubic metres of water.

Sector – Offices   **Number of offices used for analysis – 500**
From the dataset provided, given that if all office establishments in the data set were to achieve or better the typical benchmark, then approximately 467,000 cubic metres of water per annum could be saved.   It is estimated that there are 6,500 offices within the UK; therefore the total potential save for the office estate is 6,071,000 cubic metres of water.

Sector – DEFRA Laboratories   **Number of laboratories used for analysis – 14**
From the dataset provided, given that if all laboratory establishments were to achieve or better the typical benchmark approximately 810 cubic meters of water per annum could be saved.

Sector – Hospitals   **Number of Hospitals used for analysis – 273**
From the dataset provided, given that if all hospital establishments in the data set were to achieve or better the typical benchmark, then approximately 2,000,000 cubic metres of water per annum could be saved.   There are approximately 1,861 hospitals within the UK; therefore the total potential save for the hospital estate is 13,633,670 cubic metres of water.

Sector - Courts   **Number of Courts used for analysis - 44**
From the dataset provided, given that if all court establishments in the data set were to achieve or better the typical benchmark, then approximately 18,074 cubic metres of water per annum could be saved.   There are approximately 220 courts within England; therefore the total potential save for the court estate is 90,370 cubic metres of water.

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Sector – Museums

Number of Museums used for analysis – 50

From the dataset provided, given that if all museum establishments in the data set were to achieve or better the typical benchmark, then approximately 199,437 cubic metres of water per annum could be saved.

There are approximately 1,100 museums within the UK; therefore the total potential save for the museum estate is 4,387,614 cubic metres of water.

Sector – Nursing Homes

Number of Nursing Homes used for analysis - 70

From the dataset provided, given that if all nursing home establishments in the data set were to achieve or better the typical benchmark, then approximately 22,841 cubic metres of water per annum could be saved.

There are approximately 14,500 registered nursing homes within the UK; therefore the total potential save for the nursing home estate 8,077,915 cubic metres of water.

Sector – Higher & Further Education

Number of establishments used for analysis - 127

From the dataset provided, given that if all higher and further education establishments in the data set were to achieve or better the typical benchmark, then approximately 1,387,264 cubic metres of water per annum could be saved.

There are approximately 160 higher education and 500 further education establishments within the UK; based upon an estimate of net floor area of the total estate the total potential save is 20,145,000 cubic metres of water.

Sector – Public Lavatories

Number of Public Lavatories used for analysis - 86

From the dataset provided, given that if all public lavatory establishments in the data set were to achieve or better the typical benchmark, then approximately 33,578 cubic metres of water per annum could be saved.

It is estimated that there are 5,000 public lavatories within the UK; therefore the total potential save for the public lavatory estate is 1,952,178 cubic metres of water.

Sector – Police Stations

Number of Police Stations used for analysis - 141

From the dataset provided, given that if all police stations in the data set were to achieve or better the typical benchmark, then approximately 96,923 cubic metres of water per annum could be saved.

It is estimated that there are 3,300 police stations within the UK; therefore the total potential save for the police station estate is 2,268,411 cubic metres of water.

Sector – Sports Centres

Number of Sports Centres used for analysis - 65

From the dataset provided, given that if all sports centres in the data set were to achieve or better the typical benchmark, then approximately 96,335 cubic metres of water per annum could be saved.

It is estimated that there are 4,000 sports centres within the UK; therefore the total potential save for the sports centre estate is 8,757,727 cubic metres of water.

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Sector – Libraries
Number of Libraries used for analysis - 89
From the dataset provided, given that if all library establishments in the data set were to achieve or better the typical benchmark, then approximately 18,575 cubic metres of water per annum could be saved.
It is estimated that there are 6,000 libraries within the UK; therefore the total potential save for the library estate is 1,252,247 cubic metres of water.

Sector – Community Centres
Number of Community Centres used for analysis - 62
From the dataset provided, given that if all community centre establishments in the data set were to achieve or better the typical benchmark, then approximately 16,037cubic metres of water per annum could be saved.
It is estimated that there is 5,000 community centres within the UK; therefore the total potential save for the community centre estate is 1,293,307 cubic metres of water.

Sector – Fire Stations
Number of Fire Stations used for analysis - 61
From the dataset provided, given that if all fire stations in the data set were to achieve or better the typical benchmark, then approximately 23,518 cubic metres of water per annum could be saved.
It is estimated that there is 1,200 fire stations within the UK; therefore the total potential save for the school estate is 462,649 cubic metres of water.

6.5.2   From the above tables the total potential water save is 87,617,644 cubic metres

6.5.3   If an average of £0.80 is taken for the supply of water and the same for the treatment of sewerage then this equates to an overall potential saving of approximately £140.2 million.

7.0 Website

7.1   June 2002 saw the undertaking of a major overhaul and redevelopment of the Watermark website. This was to move away from the previous "online brochure" format of the site, to a single, more advanced, intelligent and interactive database driven system, offering users registered with "MY WATERMARK" the opportunity to manage their site details, add billing data, and view benchmark details via our interactive benchmarking tool.

7.2   Reidmark, a Liverpool based specialist Internet company developed the new site, in conjunction with the newly formed internet editorial team, consisting of staff from OGCenergy and Watermark team developed the new site.

7.3   For the website a number of aims were identified:

- Provide a single information source for customers
- Provide a focal point for communications
- Provide easy access to reference material
- Provide users with up to date news
- Encourage use of centralised database for disseminating information to customers
- Facilitate to move away from e-mail and telecoms as main means of communicating information to all customers and encourage staff to publish reference documents on web and send links rather than copying the document to individuals
- Facilitate customer awareness of Watermark and its associated services
- Develop an information sharing culture across the wider public sector.

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7.4   For the website a number of objectives were identified:

- Participants should be able to access the information they need as directly as is practicable (ideally within 3 mouse clicks)
- Information published should be up to date, accurate and relevant to users
- Content should be clear concise and appropriate for the site
- Links are kept up to date

7.5   An Internet editorial team was established, their functions being:

- Co-ordinate publishing of internet information in line with the timescales agreed with the information owner
- To aim to publish content within 3 working days of receipt
- Ensure all information held on the site conforms to the style specified

7.6   An interactive "MY WATERMARK" area had been developed, its functions being:

- Builds on existing watermark registration process
- Have an enhanced data capturing facility with:
  - Multiple site entries for single users
  - Dedicated user log-in to allow data to be recalled by users, updated or added, and improved benchmarking
  - Interactive benchmarking facility
  - Links into OGCbuying.solutions portfolio

8.0 CO_2 Report

8.1   Information has been sought from a variety of sources to determine the amount (and form) of energy required:

- to abstract, treat and deliver water to the end user
- to treat subsequently as wastewater

8.2   The water industry uses over 6000 GWh of energy in the UK and any reduction in water use will led to a commensurate reduction in the amount of energy to supply water and to treat as wastewater. The amount of energy used by a water company is dependent on many factors including the size and topography of the region it covers.

8.3   Nationally surface water from rain and snow adds 20% of water to the amount of water supplied and consequently returned to be treated as wastewater. However, this again varies for individual water companies depending on their location.

8.4   The use of energy produced by fossil fuels leads to the production of CO_2 (a greenhouse gas). Some water companies make use of renewable energy sources such as wind power, biogas and hydro-electricity. These sources of energy do not produce CO_2 emissions.

8.5   The national average of energy use and CO_2 emissions in 1998/99 for the supply of water and the treatment of wastewater were:

- 468 kWh per megalitre of water supplied producing 209 kg of CO_2;
- 437 kWh per megalitre of wastewater treated producing 195 kg of CO_2.

8.6   The above indicates an emission of 0.446 kg of CO_2 per kWh and compares well with the average figure for 1999 stated by the Department of Trade and Industry of 0.435 kg of CO_2 per kWh.

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8.7   Using the above figure for CO_2 emission, we estimate the following:-

- An average family of four emits 78 kg of CO_2 per year as a result of its water use.

- A typical car, using a litre of petrol for a 10-km journey, produces 2.2 kg of CO_2. Therefore, for the energy used to supply one megalitre of water and treat the resulting wastewater, a car could travel 1836 km.

8.8   If nationally, a water saving of 20% (3,440 megalitres per day) could be achieved, this would reduce CO_2 emissions by 1,356 tonnes per day equivalent to 616,000 car journeys of 10 km.

9.0 Future of the project

9.1   Services Developed

9.1.1   Due to the success of the Watermark project, it quickly became apparent that may organisations would need help in bringing water management under control.

9.1.2   Responding to this need, OGCbuying.solutions arranged a rigorous tendering exercise that led to the introduction of a framework contract, which was awarded to Adsm plc, the very same company who partnered in developing Watermark.

9.1.3   This framework contract offers customers choice and support at varying levels, catering both for customers who wish to invest in developing their water and waste systems, and for those customers who have budget restraints by offering a shared saving scheme.

9.1.4   The arrangement provides a unique opportunity for public sector organisations to meet current government targets, reduce cost, and eliminate waste both quickly and effectively.

9.2   Water Services Contract

9.2.1   This shared saving scheme includes a whole range of activities, from site survey to the design installation and maintenance of measures to suit the client's needs. The contract is over a 3-year period and includes continued monitoring and maintenance of the site. Adsm plc carries out all investment as well as free bill validation, including tariff analysis, and will seek rebates for any overcharges directly under the scheme to the customer.

9.2.3   Adsm plc are funded directly from the savings they make on a declining percentage over the period of the contract. For added user protection, we have built in a capping on the level of savings that Adsm plc can claim on sites where water bills exceed £10,000 per annum.

9.3   Surveys

9.3.1   The objective of a one-day survey is to try and identify visible wastage. Experience reveals that for the majority of sites the problems are above ground while around 20% have problems in both above and belowground. The size and complexity of a premises, and in particular the availability of isolating valves at strategic points, has a bearing on the ease of investigation but the report should give a clear description of remedies for visible wastage and the likelihood of underground leakage being present. It is possible to be absolutely certain that a site is free from underground leaks if isolating valves on all rising mains stop the meter when they are shut but if there are un-valved legs present all the constant visible losses have to be remedied before the meter can be usefully monitored for underground leakage. In this case follow on work will be required.

- All available consumption data is examined prior to going to site to assess volume and pattern use. Meter reads are usually sparse for sites not formerly within a monitoring regime so overnight and weekend

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base-loads cannot usually be seen but seasonality may be visible. The average daily volume and flow rate is logged on a standard survey sheet.

- o Site details are examined prior to going to site and logged on the survey sheet. A site diagram is usually obtained from the site management and attached to the survey sheet.

- o When on site, meters are located, read and details reconciled with the information provided to check that the correct meters are being billed to the site and also to confirm flow rates.

- o All water outlets are then identified, described and logged on the standard survey sheet. At the same time the water outlet will be assessed for their contribution to the recorded daily totals. Outlets include taps, shower heads, urinals, hoses, fountains, ponds, watering points, heating systems, cooling systems, overflows, drains, production processes and irrigation systems.

- o The surveyors carry a very sensitive electronic listening device and will test all exposed pipe-work in the grounds of the site for illicit water movement to ground.

- o Before leaving site the meters are read again to give an accurate estimate of current daily usage to compliment existing data.

- o The survey report will concentrate on an action plan to remedy inefficiencies. If an underground leak became apparent during the survey the general location, if known, is highlighted.

9.3.2 Once recommended measures have been actioned to control visible waste underground leakage can be further assessed. The metered flow is measured at times of low occupancy or activity. This is done by either reading the meters after working hours and before work starts or by attaching a temporary data logger to the meter.

9.4 Further Work

9.4.1 There are a number of areas where further work is required should funding become available for the Watermark project

9.4.2 Increase sample sizes in building categories where benchmarks have been established to increase their reliability in statistical terms would be one main activity to undertake.

9.4.3 A number of benchmark evaluations produced unsatisfactory results or areas where more data is required. For example a small sample size indicated that perhaps floor area is the best indicator for benchmarking purposes rather than no of staff. More data would be required to eliminate any doubt in the analysis.

9.4.4 Collect data to benchmark building categories that have not been analysed due to lack of data. An example of such a building category is cemeteries/crematoriums.

9.4.5 Investigate further building categories to gain a greater understanding of how buildings use water.

9.4.6 Continue to develop the website to include more sophisticated benchmarking tools as more data is collected and a greater understanding of buildings is developed.

9.4.7 Use the information gained and benchmarks established, to work with organisations to put a full water reduction strategy in place across its entire estate. Monitor this information for a much fuller case study and take the project one step further to realise substantial savings.

10.0 Conclusions and Discussion

10.1 The project has now run for 3 years, during this time the project team has accumulated considerable and significant knowledge about water conservation in general and where it is being applied to public sector organisations. Below is a summary of the main points of learning that are not already covered in this report.

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o Water seems to be the forgotten utility. Almost every organisation the project team talked too is taking electricity and gas very seriously, both in terms of conservation and purchase, however some do not take water seriously, although some of these organisations freely admit that their overall water bill is the same as their overall gas bill. Equally there are many organisations are doing nothing about any of their utilities and do not have an energy manager or team in place

o To save water is relatively straightforward. Specific knowledge on water conservation in organisations is patchy; some organisations are very knowledgeable and pro-active in managing their water whilst other organisations are doing nothing. Policy in this area is also patchy; almost every organisation the project spoke to state they did not have a specific budget for energy or water saving measures.

o There are some major quick wins to be realised from water saving management. With small investment savings in the region of 15~20% are easily obtainable.

o Where investment has been made then the payback period is usually under 12 months, this is always acceptable when putting together a business case for investment.

o Very few organisations have in-depth data of their estate with many organisations not knowing basic details such as floor areas and staff numbers.

o There has been a large degree of apathy within organisations and job protection from some individuals, often having considerable amounts of data but were not willing to share it for the benefit of the project and the wider public sector despite our assurances of confidentiality. This has been a very disappointing and frustrating aspect of the project. Many large organisations clearly thought that their estate was unique and couldn't be benchmarked, however building categories such as prisons and hospitals have established benchmarks through their co-operation. It soon became clear that some organisations were not carrying any form of data collection or conservation in regards to water and the watermark project may very well show them up to be poor performers.

o A short questionnaire was most definitely required. One of the major lessons learnt at the start of the project was to ask for too much data early on in the form of a long questionnaire. Possibly the best method of data collection is to get basic details such as staff numbers and floor area first and then approach site direct to gain other details.

o It has to be questioned why people are not addressing water conservation when the project has clearly demonstrated that savings can be made on a scale comparable to other utility savings and with a relatively short payback on investment. Possibility the reason lies in the fact that the water industry is not open to competition in the same manner as other utilities and therefore does not have the same exposure. Most people's perception of water is drawn from their experiences in the home where the majority pay for water through water rates and not metered supply. Like the majority of industrial customers they do not have a choice of supplier. Hopefully perceptions will change with increased use of water meters domestically and water industry de-regulation. It is clear that the services that Watermark have developed need to be continually marketed to increase value for money for the public sector.

10.2 On the whole the project has met all of its stated objectives, in terms of identifying potential savings however, the real challenges in the future will be to encourage departments/organisations to work towards meeting the benchmarks established by the project.

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