TECHNICAL NOTE

Job Name: Land NW of Bicester

Job No: 49556

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Subject: Potable Water Efficiency Statement

The design of the potable water supply for the proposed development of up to 530 homes will aspire to a design standard that will reduce in home water demand to 105l/p/d supplying at least 25l/p/d of the demand from a non-potable supply from local water recycling which is line with the design of the Exemplar scheme. This aspiration exceeds the Building Regulations Approved Document G that requires that the design estimate of total water consumption is less than 125 l/p/d with an optional further reduction to the lower level of 110l/p/d.

Water Efficiency Measures

In order to achieve the reduced in-home water demand of 105 l/p/d the following water efficiency measures should be considered in every new home.

- 2.6/ 4.0 l dual flush toilet.
- 9 l/minute shower.
- 150 l bath; and
- 6 l/minute taps.

The cost of using water efficient fixtures and fittings to achieve the lower 110 l/p/d is negligible, estimated at £9 per home. In comparison, reducing consumption from 125 l/p/d to 105 l/p/d was estimated to reduce energy, water and sewerage costs by around £24 per year.

Local Water Recycling

A range of local water recycling methods will be considered at the detail design stage, the proposed options for consideration are set out below: -.

Rainwater Harvesting

Rainwater harvesting involves the collection and storage of rainwater for non-potable uses such as watering gardens, flushing toilets and washing clothes. These can achieve up to a 50% reduction in mains water consumption. Systems can be installed at both individual and site-wide scales:

At the individual property level: water from the rooftop would be collected and stored in a tank, subsurface or in the loft space. Water is filtered and treated before being pumped to the point of use. The system maintenance and operation is usually the responsibility of the homeowner. On plot collection systems have the benefit of reduced transmission losses and as the householder 'owns' the system they are more likely to conserve non metered public supply water.

At the site-wide scale: water from rooftops would be collected and conveyed by a separate surface water drainage network to communal storage facilities. The storage facility could include subsurface tanks or surface ponds. The separate surface water drainage network could be a conventional pipe network with engineered filtration upstream of the storage facility or a combination of attenuation and treatment via cascading SUDS systems.

The filtered and treated water would then be pumped via a separate non-potable supply network back to the point of use in individual properties. In order to maintain a high-water quality and reduce contamination and costly treatment, site wide schemes only accept clean water from rooftops. Consequently, a sperate parallel surface water drainage system is required to deal with runoff from paved areas and roads

Stantec has been in contact with TWUL and they have confirmed that there is currently no legal framework in place to enable them to adopt the side wide scheme. The system operation and maintenance would be subject to an agreement with a maintenance contractor (to the individual property boundary).

Economics

Rainwater harvesting systems are comparatively expensive. Water efficiency fixtures and fittings discussed in the previous section are cheaper, offer short payback periods, are easier to retrofit and maintain, and should be considered before rainwater harvesting. Generally, the cost effectiveness improves with the scale of the project.

	Apartments	Houses
Code Level 1 and 2	-	-
Code Level 3 and 4 (105 l/p/d)	£6	£9
Code Level 5 and 6 (80 l/p/d)	£900	£2,201 - £2,697
Rainwater only	£887	£2,181 - £2,674

Water standards costs (extra over usual industry practice) with reference to Code for Sustainable Homes levels (Housing Standards Review Cost Impacts report, DCLG 2014).

At the Eddington – North West Cambridge development, which has the largest site wide harvesting scheme in the UK, a comparison indicated that as a guide a site-wide system would cost about half of an individual property recycling system.

Standards and Regulations

British Standards require that rainwater harvesting systems are installed with a backup supply in the event of equipment failure or unavailability of water. This means that in practice TWUL would still plan to be able to supply the typical full water demand by mains water, and therefore there is no betterment for resource planning, although environmental benefit through reduced actual usage would occur. Rainwater harvesting systems are most likely to suffer from lack of water availability during drought periods, returning the demand to the potable water system. Therefore, the potential benefits of rainwater harvesting schemes in these drought episodes could be limited. Rainwater harvesting systems should therefore be designed to meet a minimum drought frequency standard, although there is currently no national guidance on this

Rainwater harvesting systems must comply with the Water Supply (Water Fittings) Regulations 1999 and national building regulations, including British Standards EN 16941-1:2018 (which replaced BS 8515 in 2018). Non-compliance can result in public health hazards. For example, cross-connections between rainwater harvesting systems and potable water supply affecting 87 properties at the Upton eco-housing development in Northampton led to E-coli contamination of potable water. Updated guidance was issued by the Drinking Water Inspectorate to water companies to ensure wider knowledge of the risks

Greywater Harvesting

Grey Water is defined as wastewater from hand basins, baths and showers. The British Standard BS8525-1:2010 (Greywater Systems Code of Practice) advises that provided it is treated properly, grey water can be used for toilet flushing, garden use and clothes washing machines. Various treatment process technologies are available to generate clean and odourless non-potable water suitable for re-use. It can be integrated with rainwater harvesting systems.

At the individual property level: Greywater generated from non-wastewater sources, showers, washbasins, baths and collected, treated and stored in a separate self-contained unit at each property. The treated greywater (non-potable) would then be pumped back, via separate non-potable plumbing, to the property for use in toilet flushing and washing machines.
Individual property level package systems are available that employ a combination of filtration, chemical/ UV disinfection or biological processes to achieve the required non-potable water quality.

At the site-wide scale: Greywater generated from non-wastewater sources, showers, washbasins, baths is collected and transferred by a dedicated separate drain network to a centralised recycling, treatment and storage facility.

A dedicated site wide distribution network would take the treated greywater back to the properties on a demand basis and would be distributed around the non-potable supply network within the property for use in toilet flushing and washing machines. This option is therefore the most intensive in terms of additional infrastructure both at property and site wide level.

Generally, 90% efficiency in collection, treatment and resupply can be assumed providing a possible 60l/p/d of non-potable water. This significantly exceeds the projected 25l/p/d non-potable demand. The excess would need to be discharged locally to the recycling plant, e.g., outside taps at individual property level for irrigation and outdoor washing, and larger irrigation of soft landscaping for site wide schemes.

The treatment process used in domestic greywater systems and hence water quality can be affected by chemical and biological shock changes for instance hair colouring or bleach in washbasins or rinsing of cotton nappies.

Greywater harvesting would result in reduced flows entering the foul drainage network. Drain and sewer design standards would need to consider the consequence of property level treatment units being abandoned and the subsequent increased flow. The design would therefore need to account for full flow rates in the pipes if the greywater systems are abandoned but at the same time consider the need to achieve self-cleansing velocities for the lower flows. Steeper gradients or pipes with low flow channels or 'egg-shaped' pipes would need to be employed.

Economics

Grey water recycling systems are more expensive than rainwater systems due to the additional treatment needed. Consequently, these systems are typically not cost-effective at the individual property or small-scale development level and are more suitable for larger developments where the yield is large enough to generate economies of scale. See cost comparison table below:

Yield	Example building types	Costs: CAPEX + OPEX (£000)	Water cost savings (£000)	Private net benefits (£000)	Societal benefits (£000)	Total net benefit (£000)
Low (<500 m3)	Smaller households,	£45	£5	-£40	£2	-£37
Small (500 – 1,500 m3)	Larger households	£100	£52	-£48	£18	-£30

Whole life (20 years) costs and benefits for grey water recycling systems based on the systems yield (grey water produced), Extract from: Ricardo Independent Review of the Costs and Benefits of Rainwater Harvesting and Grey Water Recycling Options in the UK, Waterwise 2020

DOCUMENT ISSUE RECORD

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