

Rainwater Harvesting: Use of mass-produced underground storage tanks and the Rain Director® in **Multi-home Developments and Commercial Buildings**

A white Paper from RainWaterHarvesting.co.uk

1. Key points

- a) Mass produced two-piece tanks such as the Carat Range from Otto Graf GmbH in Germany are **cheaper** to manufacture, transport and install than one piece laid-up fibre glass or steel framed and GRP sectional tanks.
- b) The long guarantees on these products and the perfection of the seal between the two halves now makes these tanks ideal for larger scale professional applications
- c) In the case of multi-home developments, the developer can take advice from the experts whether or not to install header tanks, and if so whether to have one in each home or share. **Sharing rainwater between dwellings is usually acceptable but sharing mains water is not:** therefore a device which admits mains water to the rainwater tank is not acceptable. Clearly, a device which admits mains water backup to a header tank in each dwelling is essential. **A plain header tank with float cocks for rain and mains is also unsuitable** because the rainwater would go yellow in the warmth of the roof space; a smart header tank with automatic recirculation of rainwater (especially when the occupants leave, for example, on holiday) is essential.
- d) The Rain Director®, the best-selling means of managing rainwater around the home with its smart header tank, is therefore ideal for multi-home developments and commercial buildings. This paper outlines principles and typical installations.



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2. Improvement in high quality two piece tanks

Mass produced two-piece tanks such as the Carat Range from Otto Graf GmbH in Germany are cheaper to manufacture, transport and install than one piece laid-up fibre glass or steel framed and GRP sectional tanks. There might have been a stigma against two piece tanks because some manufacturers brought out tanks which were prone to leaking. This has now been cured, especially in the case of the Carat range from Otto Graf GmbH in Germany where rainwater harvesting has been standard in the majority of private homes and commercial buildings thanks to their eco-consciousness and tax rebates. Graf has investing 76million Euros in the plant necessary to make these tanks and we are reaping the benefit. Note that sectional tanks have joins as well, so they have no advantage in this respect.

Because Carat tanks come in two pieces they can be brought round the back of a house with limited access, even a London terrace house (*c.f.* Wansey Street case history). The height of these tanks varies from only 700mm (for the 2700 litre version) to 1050mm (for the biggest, 6500 litre version) so in many cases they can be carried in through ordinary doors.

So the manufacturing improvements and the long manufacturers' guarantees on these products now make these tanks ideal for larger scale professional applications.

3. Suitability of mass-produced tanks for professional applications

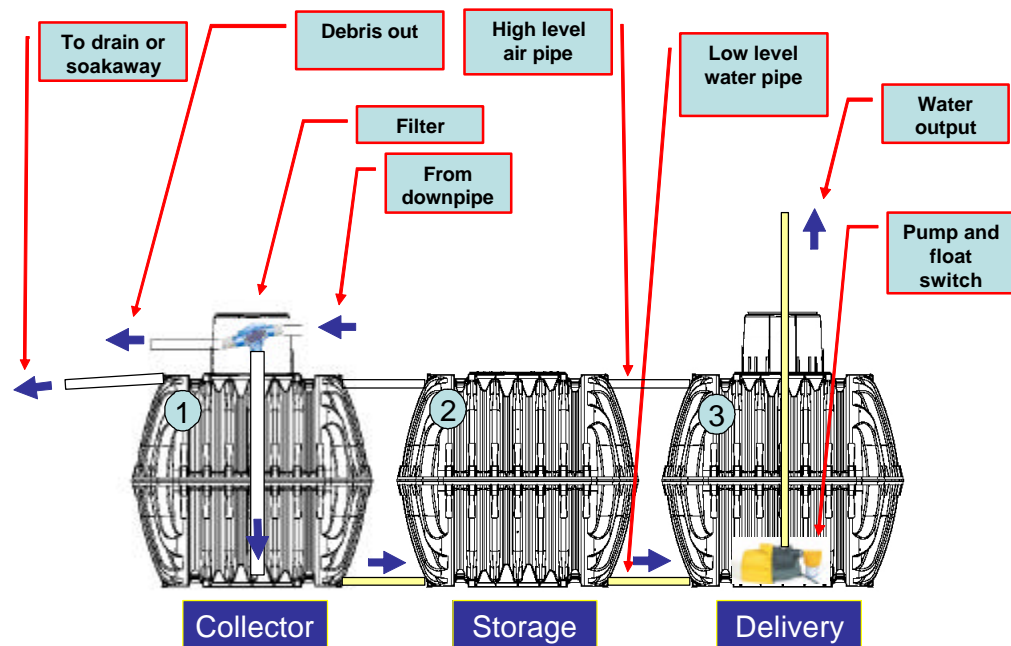
When confronted with a project requiring 20,000 to 100,000 litres of rainwater storage in the case of a multi-home development, an office block, a block of flats, a school, sports hall or care-home, consultant engineers and architects have been in the habit of specifying one piece laid-up fibre glass or steel framed and GRP sectional tanks. These tend to be expensive to manufacture, transport and install. They also require long advance order delays and the booking of a date for assembly on site by the manufacturer. One piece giant tanks have to be transported from the factory in one piece on a low loader and slow convoy, with accompanying expense.

There might also have been a bias against the mass-produced tanks on the basis of being too small. Indeed, the moulding process limits the size of underground 2-piece tanks to 6500 to 7000 litres and above ground 1-piece tanks to about 10,000 litres. However, architects and engineers are now seeing the ease with which multiple moulded tanks can be linked together in parallel, making the total volume required.

- a) The multiple tanks are ideally at the same level, linked by pipes near the bottom of each tank, so that they act as one tank (figure 1 below)
- b) In some situations it might be preferable to have a collector tank at one

Multiple tanks in series (figure 1)

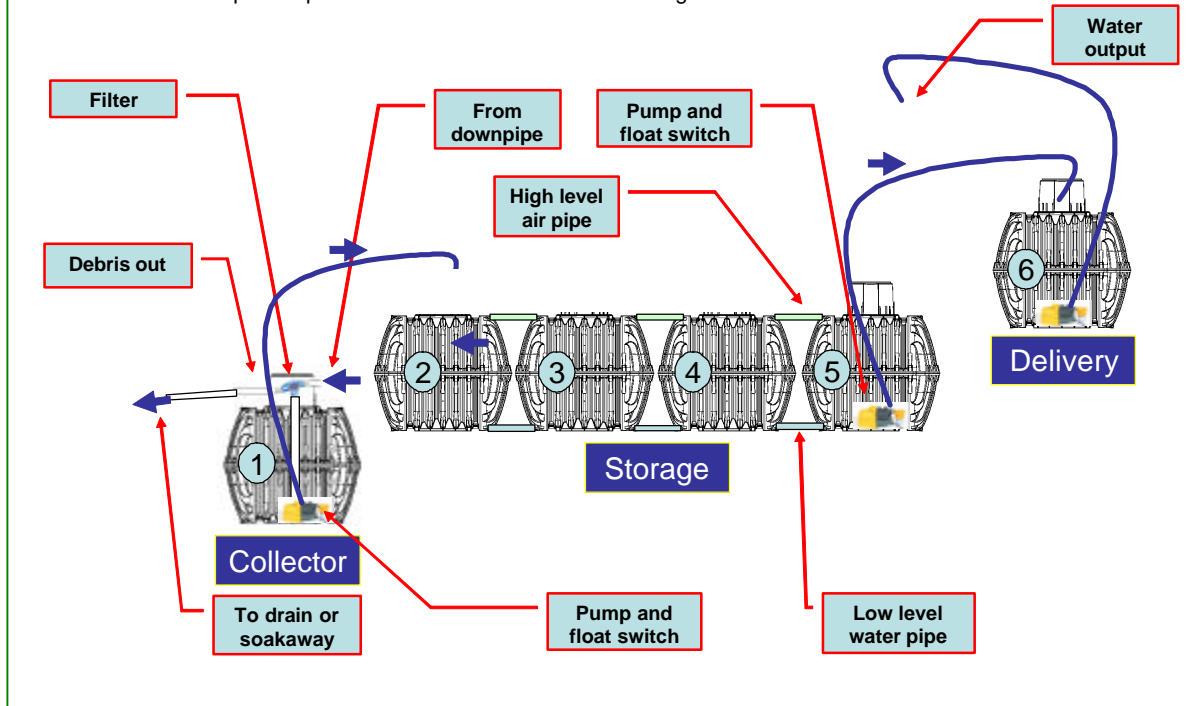
Tank 1 is the master tank and receives water from downpipes. Low level pipes take clean water to additional tanks. Pump and optional float switch are in furthest tank to ensure cleanest water.



level and a bank of storage tanks at another. Automatic pumps scavenge the collector tank by pumping up into the storage tanks. Figure 2 shows an example, but other layouts are possible.

Multiple tanks in series (figure 2)

Tank 1 is the master tank and receives water from downpipes. Low level pipes take clean water to additional tanks. Pump and optional float switch are in furthest storage tank to ensure cleanest water.



The benefits of underground tanks should not be ignored either. At the ambient temperature of the earth around the tank, there is no bacterial activity in the stored rain water. This prevents the water from getting discoloured or creating a health risk. We strongly advise against fitting rainwater tanks above ground in the open if the water is going to be used in any building for flushing toilets or washing clothes. Architects often specify a tank in a cellar, but again, one cannot guarantee that the ambient temperature there would not get above the critical threshold of 8-12°C in summer. A tank dug in below a lawn or car park takes no useful space and is therefore ergonomically more efficient in the conception of the building.

Fit tanks underground wherever possible.

4. Use of the Rain Director® in bigger commercial buildings and multi-home developments

The Rain Director®, the best-selling means of managing rainwater around the home with its smart header tank, is also ideal for multi-home developments and commercial buildings.

The initial models RH01 and RH02 were conceived for a typical home but can be used in bigger buildings equally. The smart header tank, with empty and full level sensors, and the controller on the wall on the ground floor ensure clean rainwater in the header tank at all times, feeding to the appliances by gravity. You can find out more about the Rain Director® at:

http://www.rainwaterharvesting.co.uk/downloads/raindirector_info.pdf and

http://www.rainwaterharvesting.co.uk/downloads/raindirector_manual.pdf



The

Rain Director® Plus, available in early 2010, is ideally suited to bigger buildings and commercial applications. It features 1) a level gauge, 2) BMS (Building Management System) electrical signal outputs and 3) modular large capacity header tanks to specification.

Rainwater harvesting in multi dwelling developments poses the questions of sharing the rainwater and mains water for backup and how the costs are shared. The options are discussed in the next paragraph and should be considered, and decided, early in the design process.

5. Sharing of rainwater and/or mains water in multi-home developments

Ideally, as much rainwater should be drawn from the roofs of the dwellings, even if some homes will not benefit from the rainwater. If the roofs are large enough and the rainfall sufficient, the tanks or tank systems installed should be big enough to provide rainwater throughout the year. Experts from RainWater Harvesting.co.uk can help you with these tank size calculations.

The layout of underground storage tanks and feed to each dwelling poses some social and economic problems to be resolved. We discount here the use of dumb header tanks proposed by some suppliers because rainwater is subject to bacterial action above 12°C in the warmth of a roof space and can become discoloured. A smart header tank, like the Rain Director, which flushes unused rainwater from the header back to the storage tank, is assumed.

- a) **One tank per dwelling.** The easiest option to describe is to install one rainwater harvesting tank for each dwelling. It is served by the roof of the dwelling and serves the toilets, washing machine and garden of that dwelling. When the rain runs out, the mains water backup is used by, and billed to that dwelling. Either direct feed (with mains water admitted to the rainwater tank when the rain runs out) or the Rain Director with smart header tank (in which the mains water is admitted to the header tank). Given that the additional cost of a Rain Director® (wall mounted controller and smart header tank) is less than £500, the second option here is practical, affordable and very beneficial to the occupier (see separate documentation). Each home would have its own free-standing installation.
- b) **Shared storage tank, direct feed and shared mains backup to the shared storage tank.** Where the occupiers are tenants not owners, a solution acceptable to developers is to run all the rainwater into one tank (or any number of tanks if less than the number of dwellings) and to have the pump provide rainwater to all the dwellings by direct feed. The pressure-sensitive pump, submerged in the tank, pumps water to an appliance in any of the dwellings on demand, automatically. The rainwater can be considered a communal resource and is available freely to each dwelling. In these systems, when the rainwater runs out, mains water is admitted to the common storage tank. Either, the water supply (both rain and mains) to each dwelling must be metered and charged, or it must all be made available free of charge. This lays the community open to abuse, i.e. one occupant using more water than others, but the equipment cost is low and it is an option.
- c) **Shared storage tank, shared smart header tank.** In the case of multi-home developments, one large smart header tank can be installed in the roof space of the highest home so that it feeds the appliances in all the homes in the development. This assumes rainwater storage shared by all the houses as well. As with option (b) above, either, the water supply (both rain and mains) to each dwelling must be metered and charged, or it must all be

made available free of charge. There are savings in running costs by having a smart header tank, but the equipment capital cost is higher than (b).

- d) **Shared storage tank, individual smart header tanks.** This is the option most often selected by housing associations and multi-dwelling developers. Sharing a storage tank between several dwellings (those located close to each other) greatly decreases capital equipment cost and installation cost. Rainwater is considered a communal resource. Fitting a smart header tank and controller (Rain Director) gives each dwelling control and indication of their rainwater and mains backup state, as well as the electricity savings, rainwater during a power cut and convenience. Most importantly, when the rainwater runs out, mains water admitted only to the smart header tank in the dwelling, through its own meter. Therefore the cost of mains water, if metered, is always borne in correct proportions by the occupant. This option turns out much cheaper than fitting an individual tank to each dwelling.

Note that shared storage tanks have an advantage in times of low rain or drought. Some houses use less rainwater and some might be unoccupied. Their unused rainwater would then be available to the other homes. By the same reasoning, a shared tank provides more rain attenuation: if water is being used by multiple homes, the tank is more likely to have a larger empty capacity ready to receive a storm.

Our consultancy team is available for further advice on the fitting of rainwater harvesting in multi-home developments and commercial buildings.

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multi-home-rainwater-systems.pdf & rwh_white_paper_multi-home_developments_v2_12oct09.doc
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