

WATER STORAGE TANK

FIELD OF THE INVENTION

5 The present invention relates to a water storage tank. Embodiments of the water storage tank find application, though not exclusively, for catchment and storage of rainwater in domestic and rural settings.

10 BACKGROUND OF THE INVENTION

 Tanks are commonly used for collecting rainwater runoff from roofs in domestic and rural settings via downpipes for storage of the water to supplement mains
15 water supply and other freshwater sources. In many localities, it is a requirement for new dwellings under construction or extensions to existing dwellings to include a water storage tank.

20 Conventionally, such tanks have a rounded profile and are bulky, the diameter of a tank being largely dependent on its water holding capacity. Such tanks are sealed to provide an interior volume for the reception and storage of water, and include steel tanks and tanks
25 fabricated from plastics materials.

 For many sites, it is necessary to provide adequate stormwater retention. A typical stormwater retention system is designed to collect large volumes of
30 rainwater and allow for its gradual controlled seepage into sand or aggregate, or flow to some other drainage system. Such stormwater retention systems may comprise a tank for the temporary storage of the water pending its controlled release from the system.

35 However, the installation of an above ground

water storage tank requires considerable space to be available at a site for placement of the tank. The bulkiness of conventional cylindrical tanks also requires a large amount of space for their storage and transport. Moreover, the peripheral walls of such tanks provide the requisite structural rigidity to the tanks. As such, it is necessary to fabricate the tanks from relatively heavy gauge material which increases fabrication costs.

SUMMARY OF THE INVENTION

The present invention provides a water storage tank, comprising:

(a) an outer shell that defines an interior of the tank,

(b) at least one water catchment bag located in the tank interior,

(c) at least one inlet in the outer shell for passage of water into the or bag at least one of the bags, and

(d) at least one outlet in the outer shell for passage of water from the bag or at least one of the bags out of the tank.

By using the bag or bags to collect and store water, the outer shell of the tank need not be sealed for retention of water. Moreover, the bag or bags may be arranged in a standing, self-supporting position within the outer shell of the tank to thereby provide their own structural support independently of the shell when the bag or bags are filled with water in use. This allows the outer shell of the tank to be relatively thin-walled with a concomitant saving in the cost of materials used for its

fabrication.

Preferably the bag or bags are secured in position within the interior of the tank to retain the bag
5 or bags in a substantially upright position.

Preferably the bag or bags are adapted to withstand substantially the entire hydrostatic load exerted on the bag or bags when the bag or bags are filled
10 with water.

Preferably the bag or bags are substantially self-supporting in the interior of the tank.

15 The term "self-supporting" is understood herein to mean that the bag or bags do not require the outer shell of the tank to support the bag or bags in an upright position when filled with water.

20 The tank may comprise a plurality of the bags, each in an upstanding position, arranged side by side in the interior of the tank.

Preferably the bags are interconnected for flow
25 of water from one bag to an adjacent bag.

Preferably the bags comprise openings in upper and lower sections of walls that interconnect the bags.

30 The tank may comprise one bag in an upstanding position in the interior of the tank that at least substantially fills the tank interior.

Preferably the single bag comprises a plurality
35 of spaced-apart partitions that divide the bag into a plurality of interconnected internal compartments for storing water.

Preferably the partitions are formed so that there are upper and lower openings between compartments that allow water flow between compartments.

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Preferably the internal compartments are configured to permit filling of the compartments at essentially the same time.

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The bag or bags can be formed from any suitable polymeric material.

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Preferably the tank is elongate, with parallel side walls and curved end walls, with the length of the side walls being greater than the spacing between the side walls.

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With this arrangement, preferably the tank comprises a plurality of the bags, each in an upstanding position, positioned side by side in a line in the tank interior.

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Preferably the outer shell of the tank comprises a lid which includes the inlet or at least one of the inlets, and the bag or one of the bags has an opening in a top end or has an open top end that is located in relation to the inlet to receive water from the inlet or inlets.

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Typically, the bag or bags are formed from water impermeable polyethylene multi-ply woven fabric. Suitable polymer materials for the coating and the fabric include polyethylene and polyester.

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Preferably each bag has a capacity of at least 750 litres, more preferably at least 1000 litres.

The tank may be positioned on an in situ on-site

concrete or cement slab or concrete pavers.

5 Preferably the tank comprises a purpose-built base for supporting the outer shell and the bag or bags in an operative position.

 Preferably the base closes the outer shell to prevent access of the tank interior to vermin.

10 The base may be formed from a plurality of base modules interlocked together to provide a support surface on which the bag or bags stand.

15 Preferably each base module comprises a body having at least one side for adjoining a side of another module, and interlocking members in the form of at least two spaced lugs located at the at least one side to define a shaped region therebetween, with the shape of the region being such that another lug located at the other module
20 side can be positioned in the region between the two spaced lugs in a manner that enables fastening of the lugs together to thereby join the modules at their respective adjoining sides.

25 In one form the fastening together of the lugs can be enabled by the other lug interfering with the two spaced lugs. In other words, a separate fastener is not required.

30 Preferably the interlocked base modules define a pallet on which the tank can be transported from a manufacturing location to an end-use location.

35 Preferably the base defines a pallet on which the tank can be transported from a manufacturing location to an end-use location.

The tank may comprise at least one outlet connection fitting for flow of water from the bag or bags.

5 The tank may comprise at least one overflow connection fitting for release of excess water from the tank.

10 The outer shell of the tank may comprise side walls in the form of a plurality of discrete side and end panels held together by fasteners.

Preferably the panels are sheet steel sections.

15 More preferably the sheet steel sections are profiled in cross-section to structurally reinforce the walls of the tank.

20 The panels of the outer shell and the bag or bags can be "flat packed", thereby allowing the tank to be stored and transported in a kit form and assembled on site at an end-use location.

25 Preferably the "kit" tanks are constructed so that the panels and the bag or bags of a tank can be packed and transported on a base on which the tank may be ultimately assembled. Hence, the base may be used as a pallet on which the remainder of the components of the tank can be stacked for transport to an end-use location, preferably wrapped in polyethylene or other protective
30 film to retain the components of the tank together and for protection of the components. Each component can also be individually carried to difficult to access locations compared to conventional integrally formed water storage tanks, which can substantially reduce transportation and
35 installation costs in such circumstances.

In general terms, in the context of "kit" tanks,

the present invention provides a kit for assembly of a water storage tank, the kit comprising a plurality of panels adapted to be fastened together to form an outer shell of the tank, the outer shell defining an interior
5 space for at least one water catchment bag for receiving water from an inlet in the outer shell and storing the water, and wherein the outer shell and the bag or bags are adapted to be connected together.

10 An alternative option to the above-described "kit" tank option is an integrally-formed, factory assembled tank that is transported as an assembled tank. Tanks of this type are referred to herein as "factory assembled" tanks.

15 Typically, the tank is adapted to hold at least 750 litres. There will be situations in which tanks of 750 litres will be required. There will also be situations in which tanks holding larger volumes of water
20 will be required. Tanks sizes of up to 5500 litres or more are contemplated.

The above-described tank of the present invention may be utilised as a water retention system.

25 The term "water retention" as used herein in the context of a water retention system is meant the temporary storage of water accumulated in the system pending gradual or controlled release from the system for use in a
30 domestic sense for consumption in drinking, washing of clothes, flushing of toilets, showering or bathing, watering of gardens or lawns, washing of cars or hard surfaces or in a rural sense for watering of land or animals or any other conceivable application that water
35 has in both a domestic or rural sense or discharged to a water catchment pit or pits or a drainage system or systems.

Preferably, the water retention system is a rainwater retention system for the provision of a supplementary water supply.

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The term "water" as used herein is understood in the broadest sense to include stormwater, rainwater, sewage, effluent and combinations thereof unless otherwise specified.

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Hence, the present invention also provides a water retention system comprising the above-described water storage tank.

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The present invention also provides a method for assembling a water storage tank, comprising:

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(a) locating an outer shell of the tank in an upright position, the outer shell defining an interior of the tank;

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(b) positioning at least one water catchment bag within the interior of the tank such that the bag stands in an upright position for receiving water from an inlet or at least one inlet in the outer shell; and

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(c) connecting the bag or at least one of the bags to an outlet in the outer shell for passage of water out of the tank.

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The present invention also provides a base for supporting a water storage tank wherein the base defines a pallet on which either the other components of the tank in assembled form or kit form can be transported from a manufacturing location to an end-use location,

The base may comprise one base module that

provides a support surface for the tank.

Alternatively, the base may comprise a plurality
5 of base modules interlocked together to provide a support
surface for the tank.

Preferably each base module comprises peripheral
interlocking members interlocked with corresponding
10 structures on one or more adjacent of the base modules to
form a support surface.

Preferably each base module comprises a body
having at least one side for adjoining a side of another
15 module, and interlocking members in the form of at least
two spaced lugs located at the at least one side to define
a shaped region therebetween, with the shape of the region
being such that another lug located at the other module
side can be positioned in the region between the two
20 spaced lugs in a manner that enables fastening of the lugs
together to thereby join the modules at their respective
adjoining sides.

In one form the fastening together of the lugs
25 can be enabled by the other lug interfering with the two
spaced lugs. In other words, a separate fastener is not
required.

Preferably each base module comprises an elevated
30 platform.

Preferably each base module further comprises one
or more support structures depending downwardly from the
platform for contact with a ground surface to support the
35 tank.

Preferably one or more of the support structures

is hollow and opens to a top side of the platform. The support structure or structures thereby form cavities in the platform which can be filled with sand or suitable landfill during installation of the tank to restrict lateral displacement of the tank when assembled.

Preferably the interlocked base modules define a pallet on which the outer shell and the bag or bags of the tank can be transported in a kit form from a manufacturing location to an end-use location.

The present invention also provides a base adapted to support a water storage tank, the base comprising a plurality of base modules described above that are interlocked together to provide a support surface for the tank.

The present invention also provides a base module for the assembly of a base adapted to support a water storage tank, the base module comprising interlocking members arranged to interlock with corresponding structures on one or more further of the base modules to provide at least part of support surface for placement of the tank.

Preferably each base module comprises a body having at least one side for adjoining a side of another module, and interlocking members in the form of at least two spaced lugs located at the at least one side to define a shaped region therebetween, with the shape of the region being such that another lug located at the other module side can be positioned in the region between the two spaced lugs in a manner that enables fastening of the lugs together to thereby join the modules at their respective adjoining sides.

In one form the fastening together of the lugs

can be enabled by the other lug interfering with the two spaced lugs. In other words, a separate fastener is not required.

5 The present invention also provides a water storage system for a water storage tank comprising:

10 (a) at least one water catchment bag adapted to be secured in position within an interior of an outer shell of the tank so as to stand in an essentially upright position;

15 (b) at least one inlet opening for entry of water into the bag or at least one of the bags; and

 (c) at least one outlet for flow of water from the bag or at least one of the bags.

20 The present invention also provides a water storage system for a water storage tank comprising an outer shell and a plurality of water catchment bags arranged side by side relative to one another within the interior of the outer shell so as to stand in an upright position, wherein the bags are interconnected for flow of
25 water from one bag to an adjacent bag, at least one of the bags has an inlet opening for entry of water into the bags, and at least one of the bags has an outlet opening for flow of water from the bags.

30 Any discussion of documents, acts, materials, devices, articles or the like which has been included in this specification is solely for the purpose of providing a context for the present invention. It is not to be
35 taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed in Australia or elsewhere before the

priority date of this application.

Throughout this specification the word
"comprise", or variations thereof such as "comprises" or
5 "comprising", will be understood to imply the inclusion of
a stated element, integer or step, or group of elements,
integers or steps, but not the exclusion of any other
element, integer or step, or group of elements, integers
or steps.

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The features and advantages of the present
invention will become further apparent from the following
detailed description of preferred embodiments together
with the accompanying drawings.

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BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The present invention is described further by way
of example with reference to the accompanying drawings, of
20 which:

Figure 1 is a side view of an outer shell of one
embodiment of a water storage tank of the present
invention;

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Figure 2 is a plan view of the lid of the outer
shell of the water storage tank of Figure 1 showing the
slim, elongate profile of the tank;

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Figure 3 is an end view of the outer shell of the
water storage tank of Figure 1;

Figure 4 is an end view of a bolt cover strip for
covering a joint between panels of the outer shell of the
35 water storage tank of Figure 1;

Figures 5A to 5C respectively show plan, front

and side views of a base module of a base for the outer shell shown in Figure 1;

5 Figure 6 is an isometric view of two base modules of Figure 5 when assembled together to form a knockdown pallet;

10 Figure 7 is a perspective view of one embodiment of water catchment bags in the form of bags of the water storage tank of Figure 1;

Figure 8 is a top view of the bags of Figure 7;

15 Figure 9 is a partial side view showing the interconnection of a bottom region of the bags of Figure 7 in an empty condition for passage of water from one bag to the next bag;

20 Figure 10 is a side view of an outer shell of another, although not the only other, embodiment of a water storage tank of the present invention;

25 Figure 11 is a plan view of the lid of the outer shell of the water storage tank of Figure 10;

Figure 12 is an end view of the outer shell of the water storage tank of Figure 10;

30 Figure 13 is a perspective view of another, although not the only possible other, embodiment of water catchment bags in the form of bags of the water storage tank of Figure 10 which is partially cut away to show the interconnection and more particularly the openings between adjacent bags that allow passage of water from one bag to
35 the next bag; and

Figure 14 is a cross-section along the line 14-14

in Figure 10 which shows the location of the bags shown in Figure 13 in the tank.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

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Each embodiment of the water storage tank in accordance with the present invention shown in the Figures comprises an outer shell 2 that defines an interior of the tank, a plurality of self-supporting water catchment bags 48 located in the tank interior, at least one inlet 19 in the outer shell for passage of water into the bags, at least one outlet 21 in the outer shell for passage of water from the bags out of the tank, and a base supporting the outer shell and the bags.

15

An outer shell 2 of one embodiment of the water storage tank 4 in accordance with the present invention is shown in Figure 1.

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The outer shell 2 comprises end and side panels 6 and 8 that are fabricated from thin-walled (0.55 mm) corrugated steel and a lid 16 fabricated from thin-walled steel.

25

The end and side panels 6 and 8 overlap and are respectively secured together by fasteners in the form of galvanised bolts received in aligned apertures defined in the panels, thereby forming joints generally indicated by the numeral 10 on each side of the outer shell 2.

30

Generally, the outer shell 2 of the tank has a width of from about 400 mm to about 1,500 mm but not necessarily restricted to this range and more preferably from about 550 mm to about 1,180 mm. The length of the outer shell will typically be in a range of from about 1,400 mm to about 3,600 mm and more preferably, from about 550 mm to about 1,180 mm in width. The height of the outer

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shell will typically be in a range of from about 1,300 mm to about 2,500 mm and more preferably, from about 1,540 mm to about 1,860 mm.

5 The top of each panel 6, 8 is provided with an outwardly directed flange 14 to permit attachment of the lid 16 of the outer shell 2 shown in Figure 2. The lid 16 is secured to the flange 14 of each of the end and side panels 6 and 8 by bolts received in further aligned
10 apertures equidistantly spaced around the lid 16 and flanges 14 of the panels.

 A lid support member 18 in the form of a rib indicated in phantom outline is secured to the underside
15 surface of the lid 16 by screws driven into the rib from the top side of the lid. The rib 18 is bowed providing a slight curvature in the lid for runoff of rainwater.

 The outer shell 2 of the water storage tank 4 has
20 a slim, elongate profile allowing the tank to be located alongside a residential dwelling under an eave of the dwelling such that the tank is relatively unobtrusive and at least partly covered by the eave. However, it will be understood a tank embodied by the invention may be located
25 distantly from the dwelling and fully exposed to the weather.

 As shown in Figures 1 to 3, a bolt cover 20 is secured to the outer shell 2 over each joint 10 to obscure
30 the bolts used to fasten the panels together. The bolt cover 20 is held in position by a galvanized steel clamping strip disposed in the void 21 of the bolt cover. The clamping strip has threaded apertures spaced apart along its length which receive the shafts of the bolts and
35 sandwich the opposing inwardly directed flanges 22 of the cover strip 20 against the exterior face of the outer shell 2.

The end and side panels 6 and 8 of the outer shell 2 are each provided with an outwardly directed flange 15 at their bottom edge, with spaced apart
5 apertures through which the outer shell is fastened to the base by further fasteners in the form of screws.

Typically, the end and side panels 6 and 8 of the outer shell 2 and the lid 16 are either coated with a
10 zinc aluminium alloy or zinc only to protect against corrosion. Other alternatives include pre-painted variants of either material or a polymer coated metal base product. Any suitable corrosion resistant coating can be employed and any suitable substrate can be used.

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The external faces of the panels 6, 8 and the lid 16 of the outer shell 2 may also optionally have a paint finish.

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Suitable corrugated steel strip for fabricating the end and side panels 6 and 8 of the outer shell 2 is commercially available under the trade marks Zinalume[®], Colorbond[®], Zincform[®], and Aquaplate[®] from BlueScope Steel Limited., Exposed fasteners used in the assembly of the
25 outer shell may also have a matching paint finish.

While corrugated steel strip is preferred, it will be understood that the outer shell 2 of the tank can be fabricated from any material deemed suitable, such as
30 high density polyethylene ("HDPE") or other suitable polymeric materials.

The tank inlet 19 comprises an inlet/strainer assembly (not shown) in the lid 16 to permit entry of
35 rainwater from an overhead downpipe of the dwelling into the tank.

The tank outlet 21 is in a lower section of the outer shell 2 at one end of the shell. The outlet 21 is connected to the bag 48 at that end.

5 The tank 4 also comprises a multi-component overflow outlet 27 that is plumbed to a drainage system in an upper region of the tank.

10 The outer shell 2 of the tank 4 is not sealed and, therefore, water storage by the tank is achieved entirely by the water catchment bags 48.

15 With reference to Figures 7 to 9, the water catchment bags 48 of the tank 4 are in the form of self-supporting bags 48 arranged side by side relative to one another for collecting and storing water entering the tank. The bags 48 shown have a "sausage like" formation when filled with water and are fabricated from essentially water impermeable polymer-coated multi-ply woven fabric, 20 although any other suitable such plastics material may be utilised. The seams of each respective bag 48 are heat welded together to seal the sides and bottom of each from leakage.

25 A first one of the bags 48 is arranged under the inlet/strainer assembly in the lid 16 of the outer shell 2 of the tank 4 to collect the water entering the tank. The other bags 48 are positioned side by side in a line within the tank interior.

30 Material tags 52 are provided on the bags 48 to connect the bags 48 to the outer shell 2 and hold the bags in a substantially upright condition against collapse when empty.

35 However, it is not necessary that the bags 48 be provided with tags, and any suitable means for attaching

the bags to the top region of the outer shell to retain the bags in a substantially upright condition for filling with water may be utilised. For instance, each bag 48 may be provided with an endless cord (not shown) received in a
5 draw seam provided around the top end of the bag. In this embodiment, the cord protrudes from openings in the seam at spaced apart locations along the seam, for being looped over hook elements (not shown) secured to the outer shell. Further still, a frame structure (not shown) can be
10 secured to the interior of the outer shell 2 or otherwise be provided within the outer shell for the attachment of the bags 48 to retain the bags upright when empty or the water level in the bags falls.

15 The top and the bottom regions of the bags 48 are interconnected for flow of water from one bag to the next, i.e. adjacent, through respective water openings (not shown). The water openings are formed by heat welding adjacent bags 48 together and cutting out the material of
20 the bags within the welded area.

Rather than water openings as described, alternate means may be employed to interconnect adjacent bags 48 together to permit the flow of water through the
25 bags.

The bags 48 are arranged and dimensioned to fit snugly within the interior of the tank 4 defined by the outer shell 2 of the tank when the bags are filled to
30 capacity with water. The bags are essentially inelastic and provide the principal structural support for the tank when containing water.

When the bags 48 are empty or the level of water
35 in them has fallen to a relatively low level, the outer shell 2 provides the principal structural support for the tank.

The bags 48 are dimensioned to abut respective of the end and side panels 6 and 8 of the outer shell 2 when filled with water to capacity, and thereby substantially
5 fill the interior volume of the tank, and are formed so as not to expand to an extent that deforms the outer shell 2,

For "factory assembled" tanks, the bags 48 can be folded flat and flat-packed and transported to the factory
10 site and stored until such time that they are assembled within the outer shell 2 along with the lid 16 and the fittings 19, 21, 27 to form a fully built-up factory assembled tank 4.

15 The dimensions and number of the bags 48 will vary depending on the internal dimensions of the outer shell 2 of the water storage tank. The bags 48 are generally tubular in form with a relatively small circumference relative to height. Normally also, the bags
20 of a tank 4 embodied by the present invention hold a combined volume of from about 750 litres to about 5,500 litres of water but with the flexibility to address both smaller and higher volumes in the volume range should the market demand such configurations..

25 In an alternate form, the bag 48 is a single bag that at least substantially occupies the tank interior and has discrete internal compartments (not shown) orientated in a lengthwise direction of the bag that are formed by
30 one or more longitudinal welds spaced apart across the bag to reduce water pressure exerted on the side seams(s) of the bag. In this embodiment, the weld(s) do not extend completely to the bottom of the bag 48 and thereby allow filling and emptying of each of the internal compartments
35 at essentially the same time and for flow of the water between the compartments. Similarly, the weld(s) do not extend to the top of the bag. In another form, the

internal compartments may be formed by divider panel(s) heat welded in position within the bag to the front and rear sides of the bag. The divider panels may have one or more openings provided therein to permit water flow
5 between the compartments allowing the divider panels to extend completely to the bottom of the bags 48.

It will be understood from the foregoing description that the bags 48 carry the outward pressure
10 arising from the water held within the bags. Thus, the bags when filled with water will stand freely on their own and do not rely on the outer shell 2 of the tank 4 to maintain an upright position. That is, the bags 48 require essentially no structural support from the outer
15 shell 2 when filled with water, the bags themselves being sufficiently strong to withstand the entire hydrostatic load exerted on the bags by the contained water.

Normally, the hydrostatic load will be shared by
20 the bags 48 and the outer shell 2 of the tank 4, with substantially all if not all of the pressure being accommodated by the bags. In other embodiments, the bags are disposed and dimensioned to be spaced from side walls of the tank when the bags 48 are filled with water. In
25 such embodiments, the bags may for instance be tied or otherwise secured to overhead brackets (not shown) supported by opposite side walls 6 of the outer shell to retain the bags upright when empty or the water level in the bags falls although, any alternative means for
30 retaining the bags in a substantially upright condition when empty may also be employed..

The outer shell 2 and the bags 48 stand on a purpose-built base.

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The base defines a pallet on which either the other components of the tank in assembled form or kit form

can be transported from a manufacturing location to an end-use location.

5 The base comprises one base module that provides a support surface for the tank or a plurality of base modules interlocked together to provide a support surface for the tank.

10 Figures 5 and 6 show a base that comprises a plurality of interlocking base modules 24.

15 The construction of the base modules 24 is such that the base can be utilised as a pallet on which the bags 48 and the end and side panels 6 and 8 of the tank 4 can be packed, the resulting bundle can be wrapped in polythene film for storage and transport purposes. Hence, the tank may conveniently be provided in the form of a kit for assembly at the site of installation.

20 Each base module 24 is fabricated from high density polyethylene ("HDPE") or other suitable material and has a platform 127 and peripheral interlocking members which interlock the base modules 24 together.

25 The base is formed by four of the base modules 24 arranged to form a rectangular unitary structure interlocked together against lateral separation by virtue of the reception of the interlocking members.

30 With reference to Figure 5, each base module 24 comprises a generally rectangular body portion 112 having four sides 114A-114D, with each side being adapted for close facing engagement (or joining) with a side of another like rectangular base module 24 (see Figure 6).

35 The base module 24 shown in Figure 5 comprises interlocking members in the form of three spaced lugs

116A-C that protrude from side 114A and four spaced lugs
116A-D that protrude from side 114B. The three spaced
lugs 116A-C respectively define two shaped regions 118
therebetween and the four spaced lugs 116A-D respectively
5 define three shaped regions 118 therebetween. The
interlocking members of the base module 24 also comprises
two spaced dovetail shaped lugs 120A and 120B that
protrude from the side 114C and three spaced dovetail
shaped lugs 120A to 120C that protrude from the side 114D.
10 The sides 114C and 114D are each recessed with respect to
respective overhanging lip portions 122A and 122B, with
each lip portion being defined by a continuation (integral
projection) of the body portion 112. Lugs 120A and 120B
again define a dovetail shaped area 126 therebetween and
15 lugs 120A to 120C define two dovetail shaped areas 126
therebetween.

When the lugs 116 or 120 lug of a first base
module 24 are inter-engaged with corresponding lugs of
20 other like base modules 24, the lug surfaces that inter-
engage can each be provided with corresponding
inclinations (eg. of 32.8°) to an imaginary line L (Figure
5) that extends orthogonally with respect to the upper
surface 127. This corresponding inclination at the
25 adjacent lug inter-engaged faces provides a further degree
of interlocking and for a greater degree of intermeshing
between the lugs to further enhance the self-locking
functionality of the base modules 24, thereby improving
the structural properties of a resultant pallet formed
30 from the base modules 24. It also means that a given base
module 24 can be joined/detached to another only by
manoeuvring it in a particular manner (eg. by lifting it
up and away from the other base module 24).

35 Figure 5A also illustrates the angle (ie. 60°)
subtended by each dovetail lug side face and its
respective side.

For a base formed from the base modules 24, from Figure 3 it will be seen that the legs are defined on each base module 24 such that, when two or more base modules 24
5 sides are joined, the legs of the first base module 24 are positioned adjacent to the legs of a second base module 24. This leg arrangement provides for an additional combined leg support to the resultant pallet.

10 Also, a base formed from the base modules 24 usually comprises four such base modules 24 that are connected together in use to define a square or rectangular pallet respectively. However, other base shapes comprising two or more like or different base
15 modules 24 can be easily assembled.

While in the embodiment illustrated in Figures 1-9 the base is formed from four base modules 24, in other embodiments, a different number of the base modules may be
20 utilised.

Another embodiment of a water storage tank 4 in accordance with the present invention is shown in Figures 10-14. The tank 4 is the same basic construction as the
25 tank shown in Figures 1 to 9 and the same reference numerals are used to identify the same structural features.

With reference to Figures 10-14, the outer shell
30 2 of the tank 4 is constructed from one or a series of corrugated (0.6mm BMT typically but not restricted to) steel sheets that are curved at each end of the sheet, have straight sections before and after each of the curves and are joined in an overlap joint typically by rivets, or
35 other fasteners, or joining techniques (such as welding and adhesives) to form an oval-shaped form.

The outer shell 2 of the tank 4 has a slim, elongate profile allowing the tank to be located alongside a residential dwelling under an eave of the dwelling such that the tank is relatively unobtrusive and at least partly covered by the eave. It will be understood that a tank in accordance with the present invention may be located away from the dwelling and fully exposed to the weather.

With reference to Figure 11, the tank inlet 19 comprises two inlet/strainer assemblies 19 in the lid 16 to permit entry of rainwater from overhead downpipes of the dwelling into the tank. Each inlet/strainer assembly 19 comprises a circular polypropylene frame ("PP") fastened by quick release bayonet fastenings to a retaining ring (also of PP) on the periphery of an inlet opening in the lid 16. Each inlet/strainer assembly 19 supports a stainless steel mesh to filter detritus from entering the tank. The retaining ring in turn is fastened via quick release bayonet fittings to a welded ring of polyethylene (PE) which is in turn welded to the bag 48 at that end of the tank. Additionally, the retaining ring is affixed to the welded ring through the body of the tank lid 16 via a number of corrosion resistance fasteners.

With reference to Figures 13 and 14, the tank 4 comprises a plurality of water catchment bags 48 in the form of self-supporting bags 48 arranged side by side relative to one another in upstanding positions for collecting and storing water entering the tank 4.

The bags are similar to the bags 48 shown in Figures 7 to 9 and, like those bags, are fabricated from essentially water impermeable polymer-coated, multi-ply, woven fabric. Suitable materials for the coating and the fabric include polyethylene and polyester.

The Figures show that the bags 48 have closed top and bottom ends (as viewed in the Figures). In addition, the Figures show that the bags 48 have openings 64 in upper and lower sections of the common walls between adjacent bags 48 that allow water to flow between the bags.

The tank outlet 21 for allowing water to be released from the bags 48 is in the form of an outlet fitting that is plumbed to a stop cock valve for release of water from the bags 48. The outlet 21 is in a lower region of the tank 4. The outlet 21 comprises a zinc metal diecast threaded fitting that passes through a hole cut into the outer tank shell and is connected via a series of plastic and over-moulded metal/plastic components to a PE outlet spigot having a flange that is heat welded in a corresponding position to one of the bags.

The tank 4 also comprises a multi-component overflow outlet 27 that is plumbed to a drainage system in an upper region of the tank in a similar manner. The overflow is made entirely out of plastic components, with a welded ring in polyethylene ("PE") for compatibility with the PE liner, an overflow body of polyvinyl chloride ("PVC") for solvent weldability to standard plumbing and drainage pipes, and fittings and a retaining ring made from polypropylene ("PP"). The flow capacities for respective connection fittings are determined depending on specific site conditions and requirements.

The tank 4 may also be used with the base shown in Figures 5 and 6.

The above-described embodiments of the water storage tank in accordance with the present invention have considerable advantages over conventional water tanks.

By way of example, the outer shell of the tank is relatively lightweight compared to conventional tanks and can be handled more easily by workmen. In addition, the
5 outer shell of the tank does not have to be a structural, water tight tank and this reduces fabrication costs. Furthermore, the "kit" option for the tank makes the tank a readily transportable product.

10 While a number of embodiments of the water storage tanks in accordance with the present invention have been described, it will be appreciated by persons skilled in the art that numerous variations and/or
15 modifications may be made to the invention without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

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CLAIMS

1. A water storage tank, comprising:

5 (a) an outer shell that defines an interior of the tank,

(b) at least one water catchment bag located in the tank interior,

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(c) at least one inlet in the outer shell for passage of water into the bag or at least one of the bags, and

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(d) at least one outlet in the outer shell for passage of water from the bag or at least one of the bags out of the tank.

2. The tank defined in claim 1 wherein the bag or
20 bags are secured in position within the interior of the tank.

3. The tank defined in claim 1 or claim 2 wherein the bag or bags are adapted to withstand substantially the
25 entire hydrostatic load exerted on the bag or bags when the bag or bags are filled with water.

4. The tank defined in any one of the preceding claims wherein the bag or bags are substantially self-
30 supporting in the interior of the tank.

5. The tank defined in any one of the preceding claims comprises a plurality of the bags, each in an
upstanding position, arranged side by side in the interior
35 of the tank.

6. The tank defined in claim 5 wherein the bags are interconnected for flow of water from one bag to an adjacent bag.

5 7. The tank defined in claim 6 wherein the bags comprise openings in upper and lower sections of walls that interconnect the bags.

8. The tank defined in any one of claims 1 to 4
10 comprises one bag in an upstanding position in the interior of the tank that at least substantially fills the tank interior.

9. The tank defined in claim 8 wherein the single
15 bag comprises a plurality of spaced-apart partitions that divide the bag into a plurality of interconnected internal compartments for storing water.

10. The tank defined in claim 9 wherein the
20 partitions are formed so that there are upper and lower openings between compartments that allow water flow between compartments.

11. The tank defined in claim 9 or claim 10 wherein
25 the internal compartments are configured to permit filling of the compartments at essentially the same time.

12. The tank defined in any one of the preceding
claims wherein the outer shell of the tank comprises a lid
30 which includes the inlet or at least one of the inlets, and the bag or one of the bags has an opening in a top end or has an open top end that is located in relation to the inlet to receive water from the inlet or inlets.

35 13. The tank defined in any one of the preceding claims wherein the bag or bags are formed from water impermeable polymer-coated multi-ply woven fabric.

14. The tank defined in any one of the preceding claims wherein each bag has a capacity of at least 750 litres, preferably at least 1000 litres.

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15. The tank defined in any one of the preceding claims comprises a base for supporting the outer shell and the bag or bags in an operative position of the tank.

10 16. The tank defined in claim 15 wherein the base defines a pallet on which the tank can be transported from a manufacturing location to an end-use location.

15 17. The tank defined in claim 15 or claim 16 wherein the base is formed from a plurality of base modules interlocked together to provide a support surface on which the bag or bags stand.

20 18. The tank defined in claim 17 wherein each base module comprises a body having at least one side for adjoining a side of another module, and interlocking members in the form of at least two spaced lugs located at the at least one side to define a shaped region therebetween, with the shape of the region being such that
25 another lug located at the other module side can be positioned in the region between the two spaced lugs in a manner that enables fastening of the lugs together to thereby join the modules at their respective adjoining sides.

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19 The tank defined in claim 18 wherein the fastening together of the lugs is enabled by the other lug interfering with the two spaced lugs.

35 20. The tank defined in any one of the preceding claims comprises at least one outlet connection fitting for flow of water from the bag or bags.

21. The tank defined in any one of the preceding claims comprises at least one overflow connection fitting for release of excess water from the tank.

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22. The tank defined in any one of the preceding claims wherein the outer shell of the tank comprises side walls in the form of a plurality of discrete side and end panels held together by fasteners.

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23. The tank defined in claim 22 wherein the panels are sheet steel sections.

24. The tank defined in claim 23 wherein the sheet steel sections are profiled in cross-section to structurally reinforce the walls of the tank.

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25. A kit for assembly of a water storage tank, the kit comprising a plurality of panels adapted to be fastened together to form an outer shell of the tank, the outer shell defining an interior space for at least one water catchment bag for receiving water from an inlet in the outer shell and storing the water, and wherein the outer shell and the bag or bags are adapted to be connected together.

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26. A water retention system comprising the water storage tank defined in any one of claims 1-24.

30 27. A method for assembling a water storage tank, comprising:

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(a) locating an outer shell of the tank in an upright position, the outer shell defining an interior of the tank;

(b) positioning at least one water catchment

bag within the interior of the tank such that the bag stands in an upright position for receiving water from an inlet or at least one inlets in the outer shell; and

- 5 (c) connecting the bag or at least one of the bags to an outlet in the outer shell for passage of water out of the tank.

28. A water storage system for a water storage tank
10 comprising:

 (a) at least one water catchment bag adapted to be secured in position within an interior of an outer shell of the tank so as to stand in an essentially upright
15 position;

 (b) at least one inlet opening for entry of water into the bag or at least one of the bags; and

20 (c) at least one outlet for flow of water from the bag or at least one of the bags.

29. A water storage system for a water storage tank comprising: an outer shell and a plurality of water
25 catchment bags arranged side by side relative to one another within the interior of the outer shell so as to stand in an upright position, wherein the bags are interconnected for flow of water from one bag to an adjacent bag, at least one of the bags has an inlet
30 opening for entry of water into the bags, and at least one of the bags has an outlet opening for flow of water from the bags.