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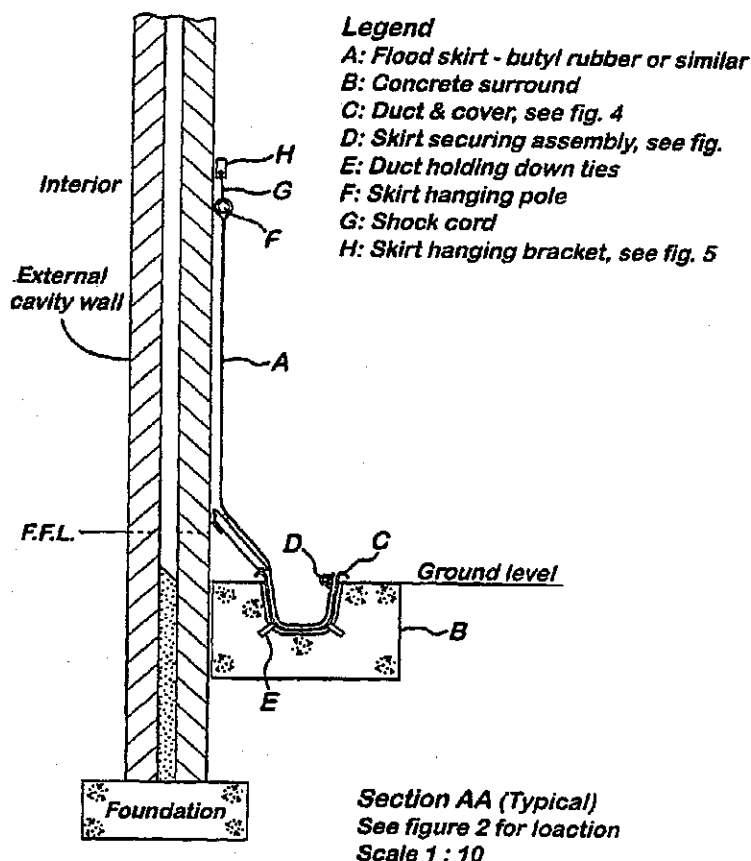
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(54) Title: FLOOD BARRIER



(57) Abstract: A flood barrier comprises a resilient trough and a flexible impermeable sheet anchored to the trough wherein the flexible impermeable sheet is capable of being stored in the trough or being extended therefrom for adjoining a structure for example a building.

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Flood Barrier

The present invention relates to a flood barrier for protecting a structure against flood damage and a method for protecting a structure from flood damage.

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Within the context of this specification the word "comprises" is taken to mean "includes, among other things". It is not intended to be construed as "consists of only".

- 10 Historically, bags filled with sand have been used to protect structures for example houses or other buildings against flood damage. A plurality of these filled bags have been placed around the base of a structure and built up to form a wall. Whilst they do provide some protection against small amounts of water they are not impermeable and in some cases it has been found that they suffer from the problem that they merely
15 filter silt from flood water allowing still dirty water to pass.

Furthermore, in view of the fact that these bags are merely a temporary measure and they are not permanently fixed in place, they are typically not available for an emergency.

20

In addition, the known sand bags are unsightly. If a sand bag splits it is possible for sand to leak from the bag leaving an undesirable deposit of sand.

- Furthermore, bags filled with sand suffer from the problem that they are heavy. As a
25 consequence of their weight they are difficult to move into place by the elderly or the infirm.

In addition, a high number of sand bags must be used to have an effect. Therefore, it has been found that it takes a considerable time to build an effective flood defence and that typically several builders are required.

- 5 To cope with the problems associated with sand bags it has been suggested that a temporary barrier of plastics sheet could be placed around a door to stop water seeping through the crack between the door and its frame. This comprises a clear plastics sheet which is placed against the side of a structure and weighted down by a weight for example a pipe filled with water. However, this suggestion has been found to
- 10 suffer from the problem that it has not been possible to provide the edges of the plastics sheet with a water proof seal. Therefore it has been found to be ineffective. Furthermore, it has been found to suffer from the problem that the sheeting is typically not available at short notice. Therefore, despite the problem associated with sand bags, they continue to be used because they provide some protection.

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Therefore, a need exists for a specialised barrier which can be used to help resist flood water and flood damage, which is easy to use in an emergency, which is permanently installed and available when needed, but which is not unsightly, and which can be employed by one or two people in a matter of minutes.

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The present invention addresses the problems set out above.

- Remarkably, it has now been found that a barrier comprising a flexible impermeable sheet of material can be permanently anchored in a trough and raised against the side
- 25 of a structure by only a small number of people at short notice to provide protection against flood damage. Furthermore, in view of the fact that it can be located in a covered trough it provides the advantage that it is not apparent or barely visible when not in use.

In accordance with a first aspect of the invention, there is provided a flood barrier which comprises a resilient trough and a flexible impermeable sheet anchored to the trough wherein the trough has a base and two walls, a cross section of the trough is tapered and the walls converge towards the base; and wherein the flexible impermeable sheet is capable of being stored in the trough or being extended therefrom for adjoining a structure.

In accordance with a second aspect of the invention, there is provided a method for protecting a structure from flood damage which comprises installing a flood barrier according to a first aspect of the invention including the steps of placing a resilient trough in the ground around a structure and securing a flexible impermeable sheet to the trough wherein the flexible impermeable sheet is capable of being stored in the trough or extended therefrom for adjoining a structure.

Preferably, an embodiment of a flood barrier according to the invention comprises a trough having a base and two walls inclined to a normal of the base. This provides the advantage that the trough is capable of being easily set in the ground although it will be appreciated that the trough could have any appropriate cross section, for example a semi circular cross section. More preferably the cross section of the trough is tapered and the walls of the trough converge towards the base. This provides the advantage that a plurality of troughs can be stacked overlapping inside each other for ease of transportation and storage.

Preferably, each wall of the trough has a lip at its edge distal to the base wherein the lip preferably comprises an outwardly turned section of the wall. This provides the advantage of facilitating fabrication as well as transportation and storage.

Preferably the trough is manufactured of a material selected from the group consisting of fibreglass, plastics, metals and a combination of two or more thereof. Metals are preferred for heavy duty instalations.

Preferably the trough is provided in sections of varying length which can be sealed together.

- 5 Preferably the trough has a depth of at least about 10cm to about 30cm. More preferably the depth of the trough is at least about 15cm to about 30cm.

- Preferably a shallow section of trough is provided that has a depth suitable for spanning over underground piping or wiring used to provide services to a structure. For example, it is known that some drainage piping is provided at a level of less than
10 about 20cm from the surface. One or more of these shallow sections of trough can be used as necessary. Preferably the depth of the shallow section of trough is about 10cm to about 20cm, more preferably about 10cm to about 15cm.

- Preferably the trough is set in concrete to secure it in position and to seal the trough in
15 the ground. Preferably, an impermeable material is placed directly against the wall of a structure from ground level down to a depth of at least about 30cm. Preferably the material abuts the concrete that the trough is set in and provides the advantage of sealing the structure against ground water. Preferably the material includes bitumen and/or polythene, for example the material is preferably BITUTHENE (TM).

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- Preferably an impermeable seal is placed at the join between the wall of a structure and underground piping or wiring used to provide services to a structure. Preferably the seal is provided by closed cell foam, for example closed cell polyurethane foam or similar. This provides the advantage of preventing moisture from entering a structure
25 at its join with underground piping or wiring. In addition, pipes, eg. drainage pipes, to the structure are fitted with non-return valves. These valves provide the advantage of inhibiting flow of liquid into the structure via the pipe, but allow flow from the structure.

Preferably, an embodiment of a flood barrier according to the invention comprises a flexible impermeable sheet manufactured of 1mm thick calendered non-reinforced flexible polyvinyl chloride (PVC-P). Remarkably, this selected material has been found to have excellent flexibility and durability compared to other known materials.

- 5 In addition, a thickness of 1mm has been found to provide remarkable strength and also light weight.

- Preferably an embodiment of the flexible impermeable sheet has a first edge which is anchored to the trough and a second edge distal to the first edge which is resilient for adjoining to a structure. Preferably the resilient edge comprises at least one rod which is preferably attached to the surface of the sheet or surrounded by a hem in the sheet. Preferably the resilient edge is detachably connectable to a fixing on a structure. The resilient edge provides the advantage that at least a section of the second side of the flexible impermeable sheet can be lifted from the trough, raised and connected to a structure quickly ensuring that the second edge of the sheet is raised uniformly to an appropriate height. It will be apparent that this height is dependent on the position of the fixing and the length between the first and second sides of the flexible impermeable sheet.

- 20 Alternatively, preferably an embodiment of a flood barrier according to the present invention comprises a flexible impermeable sheet having an edge which adjoins at least one fixing for removable attachment to a structure. Preferably the fixing adjoining the flexible impermeable sheet is complementary with a fixing which adjoins a side of the structure. For example an approximately horizontal bar can be positioned on a structure and one or more hooks can be used to detachably connect an edge of the sheet to the bar.

Preferably, the fixing adjoining a structure and complementary fixing adjoining the flexible impermeable sheet comprises a hook or hanging bracket. Most preferably it

comprises a hanging bracket. Preferably, the hanging bracket comprises a wall fitting and a hanging fitting.

- 5 Preferably the wall fitting comprises a plate for fixing to a structure and two projections for extending upwardly from each end of the plate which are inclined away from the plane of the plate. Preferably the projections lie in a plane which meets the plane of the plate at an angle of between about 2° and about 30° , more preferably about 5° . Preferably the plate defines one or more, eg. two openings through which it can be secured to a structure by fixings eg screws.

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Preferably the hanging fitting comprises a plate and a projection inclined perpendicular to the plate. The plate is capable of being slotted between a structure and the projections of the wall fitting wherein the projection of the hanging fitting extends between the projections of the wall fitting.

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The hanging bracket provides the advantage that when the flood barrier is not in use the wall fitting does not protrude dangerously from the side of a structure and is therefore unlikely to cause accidental injury to a passerby.

- 20 Preferably, an embodiment of the flood barrier comprises an elastic cord or shock cord between a hanging fitting and the edge of the impermeable sheet. This provides the advantage of applying controlled tension to the impermeable sheet until flood water forces it into position.

- 25 Preferably, an embodiment of a flood barrier according to the present invention comprises a joining means for joining a first impermeable sheet to a second impermeable sheet, for example a waterproof zipper, preferably at a side inclined perpendicular to the first and/or second side of the flexible impermeable sheet. Preferably, the zipper is of a type generally known for fastening a wetsuit and/or

drysuit. By raising the zipper two sheets can be sealed together with a waterproof seal. Alternatively, the joining means comprises material having complementary hook and loops for example VELCRO ®. This provides the advantage that the joining means can be used to join sheets together, for example at a corner of a structure. This
5 facilitates raising a waterproof flood barrier according to the invention against a plurality of sides of a structure.

Preferably, an embodiment of a flood barrier according to the invention comprises a housing for mounting on a structure, for example on a wall or side of a structure, the
10 housing having a means for receiving an edge of a flexible impermeable sheet, for example the means being a groove. Preferably the housing is applied to a structure inclined vertically and sealed to the outside wall of a structure. In addition, the housing is preferably of length equivalent to the height that the flexible impermeable sheet reaches. This provides the advantage that the flexible impermeable sheet can be
15 sealed to a wall of a structure via the housing. This is advantageous for example if a flood barrier according to the invention is used to protect only part of a structure, for example part of a semi-detached building.

In the event that an embodiment of the flood barrier is applied to only part of a
20 structure, for example part of a semi-detached building, having a cavity wall construction a cavity seal is provided to seal the cavity. Preferably the cavity seal is located directly behind the location of a housing applied to the outer wall or external surface of a structure. In this way, the outer wall of a structure is sandwiched between a cavity seal and a housing.

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Preferably, an embodiment of a flood barrier according to the invention comprises a plate fixed to the trough sandwiching the flexible impermeable sheet for ensuring a secure waterproof seal between the trough and the sheet. Preferably the plate is bolted to the trough although it will be appreciated that other secure fixings can be employed.

This provides the advantage that a secure and waterproof seal is achieved and should the sheet be damaged beyond reasonable repair it can be easily replaced.

Preferably, an embodiment of a flood barrier according to the invention comprises a
5 flexible impermeable sheet which reaches at least 1m, more preferably 1.5m, even more preferably 2m high on a structure. This provides the advantage that a structure, for example a building, is protected preferably at least to the height of a conventional ground floor windowsill or higher subject to structural adequacy of the supporting wall.

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Preferably, an embodiment of a flood barrier according to the present invention comprises a flexible impermeable sheet which is anchored to a wall of the trough distal to the structure. This provides the advantage that a waterproof seal is achieved when the barrier is in use in view of the fact that the sheet lines the trough and any
15 water in the trough sandwiches the flexible impermeable sheet against the trough. In addition, it provides the advantage that water can be removed from the trough by simply pulling the sheet tight against the wall of the trough distal to the structure.

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Preferably, an embodiment of a flood barrier according to the present invention comprises a trough having a lid or cover. Preferably the lid or cover is resilient. Preferably the lid or cover is hinged to the trough by a hinge. Preferably the hinge is located on a wall of the trough adjacent to the structure ie. opposite the wall to which the flexible impermeable sheet is anchored. The lid or cover provides the advantage that it protects and hides the flexible impermeable sheet when it is not in use. In
25 addition, when the lid or cover is raised it provides a fillet or plinth against which the flexible impermeable sheet can rest when it is in use. Furthermore, it provides the advantage that the cover can be raised against a side of the structure thereby providing additional protection against flooding. The hinge provides the advantage that the cover does not become separated and lost.

Alternatively, the cover is detachable which provides the advantage that a plurality of troughs can be stacked inside each other to facilitate transportation and storage. In a preferred embodiment the cover comprises a retaining bracket for gripping one edge of the trough and a budget lock for gripping the opposite edge of the trough. Preferably the cover can be detached from the trough and reversed to form a fillet or plinth against a structure when the flood barrier is in use. Preferably the cover is manufactured of a material selected from the group consisting of e-glass reinforced polyester resin, metal and a combination thereof. Metal is preferred for heavy duty installations.

In a preferred embodiment, the cover or lid is detachable from the trough. The cover or lid is divided into a plurality of sections. Each section comprises a top face and downwardly projecting sides. Each side comprises a slot or projection which engages with a corresponding projection or slot in the wall of the trough. Preferably the slot is L shaped and engagement is achieved by pushing the lid or cover downwardly onto the trough, ensuring that the projections insert into the corresponding slots. Thereafter the cover or lid is pushed along the longitudinal axis of the trough until the ends of the slots abut the projections.

20

Preferably each section of the cover or lid has a side having at least two projections or slots. Preferably the projections or slots are located adjacent the ends of each side. This embodiment provides the advantage that a plurality of sections of the cover or lid can be attached to the trough wherein each section is abutted by an adjacent section and thereby secured in position. Preferably, the last section of lid or cover to be placed on the trough comprises a lock to retain it in position. Advantageously, only a single lock is required to retain a plurality of sections of trough in position on the trough. This ensures that the flood barrier can be erected without delay, the cost of production is minimal and the flood barrier is not easy to vandalise.

Preferably, an embodiment of a flood barrier according to the invention comprises a pump for pumping water from the trough to the outside of the barrier distal to a structure. Preferably the pump is located in or adjacent the trough. More preferably it
5 it located in a special section of trough having a bulge or recess for the pump.
Preferably the bulge or recess extends from the longitudinal axis of the trough towards the structure. The pump provides the advantage of removing any water which leaks through the barrier. In addition, it provides the advantage of removing any water before the flexible impermeable sheet is stored after use. This prolongs the life of the
10 flexible impermeable sheet.

Preferably, an embodiment of a flood barrier according to the invention comprises at least one board, preferably a rigid board, for being positioned against a structure having one or more columns, for example a porch. The board provides the advantage
15 of reinforcing a barrier across the space between columns or a column and an adjacent structure. Therefore an embodiment of the flood barrier can be put in place around the outside of a structure having one or more columns and a flexible impermeable sheet of material can be raised against a side of the board.

20 Additional features and advantages of the present invention are described in, and will be apparent from, the description of the presently preferred embodiments which are set out below with reference to the drawings in which:

Figure 1 shows a cross section view of a wall of a structure and an adjacent flood
25 barrier in accordance with the invention;

Figure 2 shows a plan view of a structure and the position of a flood barrier according to the invention.

Figure 3 shows a possible means of a typical end connection at a partition wall.

Figure 4 shows a cross section view through a trough of a flood barrier according to the invention.

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Figure 5 shows elevation, section and plan views of a hanging bracket of a flood barrier according to the invention.

Figure 6 shows elevation and section views of a cover of a flood barrier according to the invention.

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For the purposes of clarity and a concise description features are described herein as part of the same or separate embodiments, however it will be appreciated that the scope of the invention may include embodiments having combinations of all or some of the features described.

15

As seen in Figures 1 and 4, a flood barrier or flood skirt for DIY or specialist installation comprises a resilient trough and a flexible impermeable sheet anchored to the trough wherein the flexible impermeable sheet is capable of being stored in the trough or being extended therefrom for adjoining a structure. The trough is manufactured of a material selected from the group consisting of non-ferrous metal, plastics and glass fibre. The flexible impermeable sheet is manufactured of a material selected from the group consisting of butyl rubber and plastics.

20

The trough has a base and two walls inclined to a normal of the base. The cross section of the trough is tapered and the walls converge towards the base. A pump for pumping water from the trough may be located in a special section of trough having a bulge or recess for the pump. The bulge or recess extends from the trough towards the structure.

25

The trough is provided in sections of varying length which are sealed together.

- In general the trough has a depth of at least about 15cm to about 30cm. However,
- 5 shallow sections of trough are provided which have a depth suitable for spanning over underground piping or wiring used to provide services to a structure. The depth of a shallow section of trough is about 10cm to about 15cm.

- In use, the trough is set in concrete to secure it in position and to seal the trough in the
- 10 ground. In addition, BITUTHENE (TM) is placed directly against the wall of a structure from ground level down to a depth of at least about 30cm abutting the concrete that the trough is set in. This protects against ground water.

- An impermeable seal is placed at the join between the wall of a structure and
- 15 underground piping or wiring used to provide services to a structure. The seal is provided by closed cell polyurethane foam. In addition, pipes, eg. drainage pipes, to the structure are fitted with non-return valves. These valves inhibit flow of liquid into the structure, but allow flow from the structure.

- 20 A removable resilient cover or lid is positioned on the trough and held in place by a retaining bracket and a budget lock.

- Alternatively, the cover or lid is detachable from the trough and is divided into a plurality of sections. Each section is produced by pulltrusion and comprises a top face
- 25 and downwardly projecting sides inclined parallel to the sides of the trough. Each side comprises a slot or projection which engages with a corresponding projection or slot in the wall of the trough. The projection is provided by the head of a bolt. The slot is L shaped and engagement is achieved by pushing the lid or cover downwardly onto the trough, ensuring that the projections insert into the corresponding slots.

Thereafter the cover of lid is pushed along the longitudinal axis of the trough until the end of the slots abut the projections. Each section of the cover or lid has a side having at least two projections or slots. The projections or slots are located adjacent the ends of each side. One section of the lid or cover comprises a lock to retain each section
5 of lid or cover in position on the trough.

The flexible impermeable sheet is capable of reaching a height of at least 1m on a structure and has a first edge which is anchored to the wall of the trough distal to the structure and a second edge opposite the first edge which is resilient for adjoining to a
10 structure. A plate fixed to the trough by a plurality of fixings sandwiches the first edge of the flexible impermeable sheet and ensures a secure waterproof seal. The plate is bolted to the trough. The second edge comprises at least one rod which is preferably attached to the surface of the sheet or surrounded by a hem in the sheet.

15 Alternatively, the first edge of the sheet is anchored to the wall of the trough adjacent the structure.

The rod is secured by a length of shock cord to a hanging bracket which is shown in Figure 5. It comprises a hanging fitting which is detachably connectable to a wall
20 fitting. The wall fitting comprises a plate for fixing to a structure and two projections for extending upwardly from each end of the plate which are inclined away from the plane of the plate. The projections lie in a plane which meets the plane of the plate at an angle of about 5°. The plate defines two openings through which it can be secured to a structure by fixings eg screws.

25

The hanging fitting comprises a plate and a projection inclined perpendicular to the plate.

The plate is capable of being slotted between a structure and the projections of the wall fitting wherein the projection of the handing fitting extends between the projections of the wall fitting.

- 5 The flexible impermeable sheet has a joining means, for example a waterproof zipper, at a side inclined perpendicular to the first and/or second side of the flexible impermeable sheet. The zipper is of a type generally known for fastening a wetsuit and/or drysuit. By raising the zipper two sheets can be sealed together with a waterproof seal. Alternatively, the joining means comprises material having
- 10 complementary hook and loops for example VELCRO ®.

In cases wherein an embodiment of a flood barrier according to the invention is used to protect only part of a structure, for example part of a semi-detached building, a wall housing or wall fixing for mounting on a wall of a structure has a mounting plate, strip

15 of rubber and zip to support an end of the flexible impermeable sheet. The housing is applied vertically and sealed to the outside of an external wall of a structure. The housing is preferably of length equivalent to the height that the flexible impermeable sheet reaches. The wall housing is manufactured of a material selected from the group consisting of plastics, glass fibre, rubber and non-ferrous metal.

20

In cases where an embodiment of the flood barrier is applied to only part of a structure, for example a semi-detached building, having a cavity wall construction a cavity seal is provided to seal the cavity. The cavity seal is located directly behind the location of a wall housing applied to the external surface of a structure.

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It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present invention and without diminishing its attendant advantages. It is

therefore intended that such changes and modifications are covered by the appended claims.

CLAIMS

1. A flood barrier which comprises a resilient trough and a flexible impermeable sheet anchored to the trough wherein the trough has a base and two walls, a cross section of the trough is tapered and the walls converge towards the base; and wherein the flexible impermeable sheet is capable of being stored in the trough or being extended therefrom for adjoining a structure.
2. A flood barrier according to any preceding claim wherein a shallow section of trough is provided that has a depth suitable for spanning over underground piping or wiring used to provide services to a structure.
3. A flood barrier according to any preceding claim wherein the trough is set in concrete.
4. A flood barrier according to any preceding claim wherein an impermeable seal is placed at the join between the wall of a structure and underground piping or wiring used to provide services to a structure.
5. A flood barrier according to any preceding claim wherein an impermeable material is placed directly against the wall of a structure from ground level downwards for sealing the structure against ground water.
6. A flood barrier according to any preceding claim wherein the flexible impermeable sheet has a first edge which is anchored to the trough and a second edge opposite the first edge which is resilient for adjoining to a structure.

7. A flood barrier according to claim 6 wherein the resilient edge comprises at least one rod which is preferably attached to the surface of the sheet or surrounded by a hem in the sheet.
8. A flood barrier according to claim 6 or 7 wherein shock cord is secured to the resilient edge.
9. A food barrier according to claim 8 wherein the shock cord is secured to a hanging bracket.
10. A flood barrier according to any preceding claim wherein the flexible impermeable sheet is manufactured of 1mm thick calendered non-reinforced flexible polyvinyl chloride (PVC-P).
11. A flood barrier according to any preceding claim wherein the flexible impermeable sheet has an edge which comprises at least one fixing for adjoining to a structure.
12. A flood barrier according to any preceding claim wherein the flexible impermeable sheet has a joining means for joining a first impermeable sheet to a second impermeable sheet.
13. A flood barrier according to claim 12 wherein the joining means comprises a waterproof zipper or material having complementary hook and loops.
14. A flood barrier according to any preceding claim which comprises a housing for mounting on a structure, the housing having a groove for receiving an edge of the flexible impermeable sheet.

15. A flood barrier according to any preceding claim which comprises a plate fixed to the trough sandwiching the flexible impermeable sheet for ensuring a secure waterproof seal.
16. A flood barrier according to claim 15 wherein the plate is bolted to the trough.
17. A flood barrier according to any preceding claim which comprises a flexible impermeable sheet which reaches a height of at least 1m on a structure.
18. A flood barrier according to any preceding claim which comprises a flexible impermeable sheet which is anchored to a wall of the trough distal to a structure.
19. A flood barrier according to any preceding claim which comprises a trough having a cover or lid.
20. A flood barrier according to claim 19 wherein the cover is detachable from the trough.
21. A flood barrier according to any preceding claim which comprises a cover or lid which is divided into a plurality of sections and each section comprises a top face and downwardly projecting sides.
22. A flood barrier according to claim 21 wherein each side of the cover or lid comprises a slot or projection which engages with a corresponding projection or slot in the wall of the trough.
23. A flood barrier according to claim 22 wherein the slot is L shaped and engagement is achieved by pushing the lid or cover downwardly onto the trough, ensuring that the projections insert into the corresponding slots.
24. A flood barrier according to any preceding claim which comprises a pump for pumping water from the trough to the outside of the barrier distal to a structure.

25. A flood barrier according to claim 24 wherein the pump is located in or adjacent the trough.
26. A flood barrier according to any preceding claim which comprises at least one rigid board for being positioned against a structure having one or more columns, for example a porch.
27. A method for protecting a structure from flood damage which comprises installing a flood barrier according to any preceding claim,
28. A method according to claim 27 which comprises the steps of placing a resilient trough in the ground around a structure and securing a flexible impermeable sheet to the trough wherein the flexible impermeable sheet is capable of being stored in the trough or extended therefrom for adjoining a structure.