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MODULAR SYSTEM AND METHOD FOR FLUID MANAGEMENT

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ABSTRACT

The present invention relates to onsite fluid management. In one embodiment there is provided a tank unit for a modular onsite fluid management system adapted to receive unprocessed fluid, the tank unit comprising:

- a first part forming a refuse pit for collection of waste from the unprocessed fluid;

- a second part forming a flow control chamber adapted to limit discharge of fluid to a drainage outlet at a predetermined discharge flow rate;

- a baffle separating the first and second parts; and

- a connection to a storage reservoir.

Figure 1

1/18

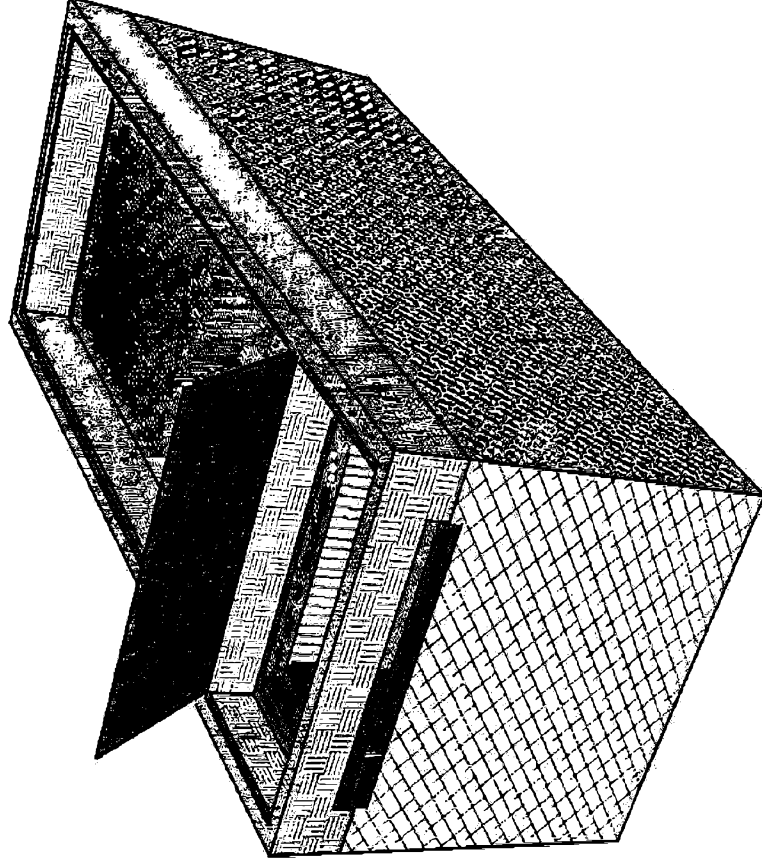


Figure 1

MODULAR SYSTEM AND METHOD FOR FLUID MANAGEMENT

FIELD OF INVENTION

[001] The present invention relates to onsite fluid management. In a preferred form, the present invention relates to on site detention systems. It will be convenient to hereinafter describe the invention in relation to the use of concrete tanks for storage and/or diversion of storm water in an onsite detention method and system, however it should be appreciated that the present invention is not limited to that use, only. In this respect, the invention may also find application in a combined onsite water management system for both detention and retention or in waste fluid treatment systems, including, for example, oil separation.

BACKGROUND ART

[002] It is to be appreciated that any discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the present invention. Further, the discussion throughout this specification comes about due to the realisation of the inventor and/or the identification of certain related art problems by the inventor. Moreover, any discussion of material such as documents, devices, acts or knowledge in this specification is included to explain the context of the invention in terms of the inventor's knowledge and experience and, accordingly, any such discussion should not be taken as an admission that any of the material forms part of the prior art base or the common general knowledge in the relevant art in Australia, or elsewhere, on or before the priority date of the disclosure and claims herein.

[003] On Site Detention Systems, sometimes referred to simply but somewhat erroneously as retention systems, are designed to capture excess stormwater during a rain event and temporarily store this water and release it slowly. The aim of these systems is to prevent stormwater run-off from new dwellings and other projects from overloading existing water board and council infrastructure, which may otherwise cause localised flooding. The physical requirements for on-site detention can vary considerably from site to site and with that there are also variations in requirements from council to council.

[004] Generally speaking, on site detention of water ordinarily refers to systems for On-site Stormwater Detention (OSD), which is primarily a stormwater management technique enabling the runoff discharge rates of individual sites to be controlled. As indicated above OSD systems help relieve the pressure on local and municipal councils to provide retarding basins in built up areas. They also help relieve pressure on overloaded drains. Many councils will require the installation of OSD tanks for new property developments. Exemplary guidelines for OSD are published by Sydney Water, a water authority in New South Wales, and are found at https://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdcw/~edisp/dd_070266.pdf, which was current at 21 August 2014. As would be readily seen from a review of the Sydney Water guidelines, the type of construction and developments that require OSD are set out or prescribed and would be understood and appreciated by the person skilled in the art. Accordingly, most constructions of substance on development sites require some form of OSD.

[005] Likewise, guidelines under the local Victorian authority of the Melton Shire Council which is proximate the Melbourne metropolitan area may be found at the following URL, which provides another booklet type set of guidelines file:///C:/Users/matt/Downloads/On-Site_Stormwater_Detention_Guidelines.pdf.

[006] Whilst the introductory section of the Melton Shire Council reference prepared by their engineering services in 2009 is aimed for their specific community needs, it also provides a summary of the requirement for OSD systems in typical urban and increasingly rural locations as follows. Redevelopment of a site usually increases the area covered by impervious surfaces such as roofing and ground level 'hard surfaces' such as paving and driveways. The change in the average permeability of the site significantly increases the volume and flow rate of storm water runoff and the additional drainage loads may cause local flash flooding downstream of the site. Due to the number of residential redevelopments and other redevelopments taking place within the Shire, it has become necessary to limit the peak rate of runoff reaching the Council's drainage system. On-site Stormwater Detention (OSD) is a stormwater management technique that enables the runoff discharge rates of individual development sites to be controlled. An OSD system requires a flow control device to limit the discharge to an acceptable rate and a storage system to hold the

excess discharge for slow release to manage load on the downstream system or at least until capacity becomes available in the downstream drainage system. Large detention basins are expensive even if built on public land and only provide protection against downstream flooding. Properties upstream of a detention basin are not protected from the increased runoff caused by redevelopment. Well-designed OSD systems control the peak discharge rates to match the capacity of the downstream drainage system. The total volume of stormwater leaving the site is not reduced but the retained volume is released when downstream drainage capacity becomes available. Having a requirement for the installation of OSD systems on redevelopment sites ensures there are no adverse impacts from stormwater runoff on downstream properties as a result of ongoing development in the catchment.

[007] These considerations should be borne in mind by land owners, builders and developers who design and build an OSD system connecting to an authority's stormwater assets and design guidelines may need to be taken into account. For example, under the Sydney Water guidelines, it may be necessary for an OSD system to be able to do the following:

- store the run-off caused by a storm event up to the 100 year ARI (average recurrence interval) for the site; and,
- control the rate of discharge to ensure downstream stormwater assets can handle the extra run-off.

[008] As set out in the design calculations of the Sydney Water reference cited above, to achieve an adequate OSD system in a given development the Sydney Water authority will formulate both a Permissible Site Discharge (PSD), which is the maximum rate of discharge for the total site that the existing downstream stormwater system can handle and a Site Storage Requirement (SSR), which is the minimum storage volume that is needed to temporarily store and offset the excess stormwater run-off due to the development. Factors to take into account when formulating these requirements are the location of the development site, the total site area, the existing pre-development impervious area of the site, and the proposed post-development impervious area of the site.

[009] Council and local authority infrastructure is usually only capable of handling a certain water flow and as more and more developments are being built in existing

suburbs around the country more run off water can be expected. Newer areas also can reduce the size of their infrastructure (such as piping) if they restrict or slow down the water from new developments entering into their stormwater piping.

5 [0010] According to the design calculations of the Sydney Water reference cited above, the amount of water to be retaining on site is calculated using council and local government formulas and engineering specifications. An OSD system must have a pre-determined amount of water storage. They must also release water slowly to council infrastructure via a predetermined size orifice. This orifice outlet is connected to site stormwater. The OSD systems also must have a normal overflow in 10 the event of a very heavy rain event when the tanks can fill as the restriction orifice is unable to cope with the water flow if tanks become full. OSD system storage tanks are empty most of the time except in a rain event.

[0011] It is considered that the NSW guidelines and requirements are much stricter than those in Victoria. However, Victoria is anticipated to adopt NSW guidelines in 15 the next few years. Moreover, the NSW systems requirements have advanced to become quite complex in recent times.

[0012] In some cases, OSD systems may be communal, rather than localised on 20 **one person's property**. In communal situations properties share their water retention capacities for convenience. Larger developments often have communal systems to comply with council requirements.

[0013] Existing OSD systems traditionally use all forms of underground types of structures to retain water and release it slowly in order to avoid the limitations that are evident in existing above ground solutions. These systems are traditionally built using a collection network consisting of gutters, channels, pipes and surface grading in 25 combination with discharge pits in the form of concrete blocks or similar (and plastic tanks on occasions) underground as in many places space is limited.

[0014] Occasionally an above ground water tank may be used but this takes up a huge amount of space and often looks unsightly. Furthermore, known above ground storage tanks ordinarily cannot take ground level hard surface runoff water without 30 use of a pump or having to be situated at the lowest point on the site, if that is possible. It should also be noted that a water storage for 'tank water' per se can only

take relatively clean roof water and not hard surface runoff whereas an OSD system can take roof water as well as hard surface runoff. Moreover, if a storage is to be utilised for both OSD and tank water supply, then all the input water must come from the roof.

- 5 [0015] When building an underground OSD system each site must be individually designed to comply with council requirements at considerable (often substantial) cost to the home owner or developer. Many OSD systems are placed under driveways through lack of space. However, it can be undesirable to have a major structure such as this under a driveway, which can be costly and difficult to construct. Furthermore,
10 trouble shooting in the event of a leak is very difficult.

- [0016] OSD systems may encompass a range of water/liquid storage structures, from round large pipes, with diameters in the order of 600mm, placed underground and interlinked to plastic and concrete tanks or custom designed concrete block units. In most cases these underground liquid storage units need to drain to infrastructure
15 naturally without the need for a pump. In some cases, for example where the underground structure is at a lower level to council infrastructure for draining, a pump with backup power supply is also needed to ensure tanks are emptied as required. Access to these underground structures is also a necessity. For example, as well as cleaning and any other maintenance, this structure also needs to be inspected
20 regularly to ensure it is functioning normally, for instance, ensuring there are no structural breaches or that batteries are fully charged. These systems are usually quite deep underground being in the range of 3m from top to bottom.

- [0017] A pre-determined sized orifice is usually to be installed in the system to allow water/liquid to slowly drain away to avoid flooding the infrastructure. Typically,
25 hydraulics engineers specify orifice size which is then approved by council.

- [0018] An example system is disclosed in US patent No. 6,991,402 (Burkhart). Burkhart addresses some stated problems with underground OSD systems. In particular, Burkhart notes that one disadvantage of current underground systems is that they must accommodate existing or planned underground facilities such as
30 utilities and other buried conduits. At the same time, the underground storm water retention or detention system must be effective in diverting storm water from the

ground surface to another location. Another disadvantage of underground systems noted by Burkhart is that they do not provide unrestricted storm water flow throughout the system. So, according to Burkhart, it is desirable to provide a system which can permit relatively unconstrained flow throughout the system. Burkhart describes a

5 modular assembly for retaining or detaining storm water beneath a ground surface. The modules of this system are essentially open units comprising a substantially horizontally disposed deck portion and at least one substantially vertically disposed side portion extending therefrom. The deck portion and side portion have respective end edges, and the side portion has bottom edges. The side portion and the deck

10 portion define a longitudinal channel which is open at least at an end of the module. The side portion has at least one opening therein and defines a lateral channel in the module. The longitudinal and lateral channels are in fluid communication with one another. Each channel has about the same cross section and extends upwardly from the bottom edges to allow relatively unconstrained flow in the longitudinal and lateral

15 directions. Burkhart is a retention system that is for permanent in situ installation.

[0019] One of the criteria for OSD systems mentioned above is that they require a flow control device and to satisfy this they frequently require a HED (High Early Discharge) storage area. The HED storage area forms part of the overall storage requirement. The HED storage is generally a smaller reservoir contained within, or

20 separately, to the main OSD liquid storage reservoir, but they are linked via piping or any other appropriate means. The HED unit fills first in a rain event. The HED unit also has the orifice located in its structure to discharge the storm water. This design is required to provide a constant water pressure to the orifice, which releases water slowly at a given flow rate to the council infrastructure. In a storm event this storage

25 area will fill first (water inflow is directed to this tank first) and then overflow from the HED unit is directed into the main storage area. The smaller HED reservoir is required to enable engineers to more accurately determine the orifice size and required flow discharge rate to comply with council and statutory requirements. However, it is often the case that there is little consideration given by council

30 engineers and hydraulics engineers as to how all this is going to be achieved in the field.

[0020] Pressure is more likely to remain constant in this case if the HED unit is full during the rain event with the rest of the reservoir used as back up storage. Traditionally these separate compartments are contained within or in tandem with the overall liquid storage device. In cases where they are custom designed they are often very complicated to design, and hugely costly to construct particularly if rock is involved.

[0021] Once the stormwater flows into the HED unit, which usually fills quickly, it overflows into the general storage area that holds the bulk of the water. Once the water in the HED unit has drained away through the small orifice there needs to be a mechanism where the water from the main reservoir can also then be released into the HED storage structure until storage capacity of the entire OSD system is NIL.

[0022] The HED unit usually has a pipe structure at the base of the HED reservoir and is interconnected to the main reservoir using a pipe or conduit with an in line one way check valve fitted to allow water to flow back into the HED unit once the HED unit levels drop. The HED unit receives water from the main bulk liquid storage device without allowing the HED unit water/liquid to flow into the main bulk storage liquid storage device via this means. The HED unit still has a main overflow pipe connected to the main liquid storage reservoir in case of any heavy rain event.

[0023] An OSD system is required to have an orifice to allow the storm water to drain to the stormwater pipe system at a predetermined rate and this orifice is usually located in the HED unit. This orifice may be located anywhere in the HED unit. If a HED unit is not employed anywhere in the water storage reservoir system this orifice may be located anywhere in the system. It is also desirable but not essential to have these OSD systems with their structures such as orifice plates located underground (if possible) to avoid consumers from accessing these pipes and turning their OSD system into storage tanks.

[0024] Some systems do not have HED units and are not mandatory in some councils at this stage. In this case, the liquid storage reservoir of the OSD system simply receives the liquid run off and releases it slowly.

[0025] In most OSD systems roof water and water from hard ground surface area is directed into the OSD system. Given that stormwater is rainwater plus anything the

rain carries along with it, this provides issues in regard to contamination from at least the hard ground surface area. Items such as gravel, stones and general rubbish can find its way into the main storage rendering them ineffective over time. Consequently, most councils and statutory authorities require a trash pit and/or sediment pit to be situated prior to the OSD system. Generally, these pits may vary in size (either as an individual pit or several pits) with a grate on top and a liquid storage area with a filter or mesh to contain the rubbish, sediment and any other refuse washed in.

[0026] The addition of pits is not always convenient and engineers, builders and the like have to manage overall heights of the pits to match their OSD system to ensure adequate flow. These pits must also be readily accessible for cleaning. Furthermore, ground water pits are required to have bike and child proof grates installed and often need to be strong enough to take the weight of a motor vehicle if they drive on them. All this adds considerably to their cost.

[0027] Most often, building owners, builders and/or hydraulics engineers are perplexed as to how to design and adhere to council requirements for each site.

[0028] A number of problems and deficiencies of existing on site detention systems may be itemised, as follows:

- They are hugely expensive;
- They need very costly specific engineering for each individual site;
- They are often cumbersome and need to be placed underground, which often involves excavation of rock;
- They require large areas of space;
- If above ground, they are unsightly and of limited usefulness;
- They are often of very complicated designs by their nature;
- They are often overengineered;

[0029] It is not uncommon for an OSD system to hold in the order of up to around 30,000 litres and to have an installation cost upwards of A\$60,000. More common is capacity of about 20,000 litres at a cost of around A\$40,000.

5 [0030] The preceding discussion of the background art is intended to facilitate an understanding of the present invention only. The discussion is not an acknowledgement or admission that any of the material referred to is or was part of the common general knowledge as at the priority date of the application.

10 [0031] With the above discussion in mind, it would be desirable to provide a retention system that is flexible in design and easy to install at reduced cost compared to the prior art.

SUMMARY OF INVENTION

[0032] It is an object of the embodiments described herein to overcome or alleviate at least one of the above noted drawbacks of related art systems or to at least provide a useful alternative to related art systems.

15 [0033] In accordance with the present invention, there is provided a method, apparatus and system for an onsite fluid management system comprising one or a combination of predetermined sized tanks configured to form a structural formation, the structural formation comprising: an inlet for unprocessed fluid; a flow control chamber adapted to limit discharge of fluid to a drainage outlet at a predetermined
20 discharge flow rate; a storage reservoir for receiving excess discharge from the flow control chamber and adapted for equalised flow back to the flow control chamber wherein the equalised flow is limited to the predetermined discharge flow rate .

[0034] Furthermore, in preferred embodiments, one or a combination of the inlet and the flow control chamber includes a refuse pit for collection of waste from the
25 unprocessed inlet fluid.

[0035] In accordance with embodiments, the inlet, the flow control chamber, the storage reservoir or the refuse pit are formed by one of:

a tank;

a part of a tank or;

a plurality of tanks.

[0036] As described with embodiments herein the structural formation comprises one or a combination of:

5 a retainer wall;

a pool;

a pergola;

a fence;

a wall.

10 [0037] In another aspect of embodiments disclosed herein there is provided apparatus for a tank unit for a modular onsite fluid management system adapted to receive unprocessed fluid, the tank unit comprising: a first part forming a refuse pit for collection of waste from the unprocessed fluid; a second part forming a flow control chamber adapted to limit discharge of fluid to a drainage outlet at a predetermined
15 discharge flow rate; a baffle separating the first and second parts; and a connection to a storage reservoir.

[0038] Other aspects and preferred forms are disclosed in the specification and/or defined in the appended claims, forming a part of the description of the invention.

20 [0039] In essence, embodiments of the present invention stem from the realization that a modular approach to on-site detention and retention of fluids can be accomplished with the applicant's predetermined sized tanks configured to form a structural formation. Advantageously, the solution herein described addresses below or above ground systems and obviates the conventional need for and OSD system at the same time as enhancing the landscape of a site and property.

25 [0040] Embodiments of the present invention provide the following advantages:

- * Using the tanks of preferred embodiments or pre-configuration of tanks is much simpler and less costly than prior art retention system designs and

delivers a great looking result to last a lifetime. The tank configurations are versatile to suit almost any hydraulics design and may be coupled to suit any design and storage capacity;

- 5 * Ease of maintenance because leakage may be localised to a specific number of tank modules;
- * Ease of cleaning and inspection access;
- * Substantial simplification of OSD design parameters;
- 10 * Modular tanks of preferred embodiments have an inbuilt trash pit, which may be located anywhere in a line of tanks to suit each site. This eliminates a remote trash pit and makes plumbing easier;
- * Further, the trash pit has an access lid for easy cleaning;
- * The trash pit also acts as a silt pit to prevent slurry from finding its way into the storage tanks;
- * The trash pit has a cast in mesh filter to suit individual site projects;
- 15 * Water from the trash pit flows into the reservoir formed by one or a bank of similar tanks through mesh retaining junk in the trash pit for easy cleaning of the system;
- * No other system has water storage built into trash pit or vice versa;
- * Embodiments of the invention using modular design of configured tanks avoids or ameliorates the high cost involved for calculation of run-off water storage in OSD systems and the additional custom design for specific sites;
- 20 * Installation is simplified where tanks do not require footings;
- * Adaptable to limited space;
- * May avoid underground installations for OSD.

25 **BRIEF DESCRIPTION OF THE DRAWINGS**

[0041] Further disclosure, objects, advantages and aspects of preferred and other embodiments of the present invention may be better understood by those skilled in the relevant art by reference to the following description of embodiments taken in conjunction with the accompanying drawings, which are given by way of illustration only, and thus are not limitative of the disclosure herein, and in which:

30

Figure 1 is a perspective view of a modified tank unit in accordance with an embodiment of the present invention;

Figure 2 is an end view of the tank unit of Figure 1;

Figure 3 is a top perspective view of the tank of Figure 1;

5 Figure 4 is a top end perspective view of a modified tank unit in accordance with an embodiment of the present invention;

Figure 5 is a perspective view of a modular fluid management system incorporating a plurality of tanks as an OSD system and with at least one tank being adapted to function as a HED unit with a refuse pit in accordance with an embodiment
10 of the present invention;

Figure 6 is a further perspective view of the modular fluid management system of Figure 5;

Figure 7 is a perspective view of a combined retainer wall and modular fluid management system in accordance with an embodiment of the present invention;

15 Figure 8 is modular fluid management system incorporated into a driveway in accordance with an embodiment of the present invention;

Figure 9 is a perspective exploded view of a modular tank unit including a planter top in accordance with an embodiment of the present invention;

Figure 10 is a perspective side view of a modular fluid management system incorporating an open vented plumbing arrangement in accordance with another
20 embodiment of the present invention;

Figure 11 is a perspective view of a modified tank unit in accordance with yet a further embodiment of the present invention;

Figure 12 is a top side perspective view of a modified tank unit illustrating a
25 mesh cage in accordance with an embodiment of the present invention;

Figure 13 is a perspective top view of a modified tank unit including a floating top to suit slotted tank access for storm water in accordance with an embodiment of the present invention;

Figure 14 is a side perspective view of a modified tank unit adapted for both water retention and onsite detention in accordance with an embodiment of the present invention;

Figure 15 is a perspective view of a pergola comprised of a modular fluid management system in accordance with an embodiment of the present invention;

Figure 16a is a perspective side cut away view of a modular fluid management system adapted for waste water and oil treatment in accordance with an embodiment of the present invention;

Figure 16b is a perspective side view of the modular fluid management system of Figure 16a;

Figure 17 a perspective side cut away view of a modular fluid management system in which the HED unit of an OSD system is situated away from an end of the modular system in accordance with an embodiment of the present invention;

Figure 18 is a side perspective view of a modified tank unit in accordance with another embodiment of the present invention;

Figure 19 is a side perspective cut away view of the modular fluid management system of Figures 5 and 6.

DETAILED DESCRIPTION

[0042] A preferred embodiment of the invention will be described, by way of example, with reference to and in the context of a domestic landscape construction site.

[0043] Published Australian Patent Application No. AU 2017200217 in the name of the present applicant discloses liquid storage tanks pre-engineered of heavy duty concrete for use as retaining walls, front fences, pool or pergola surrounds/supports. Published Australian Patent Application No 2010286347 also in the name of the

present applicant discloses a liquid reservoir connection system as well as its use with liquid storage tanks as disclosed in AU 2017200217. Reference is made to the present applicant's co-pending patent applications and the disclosure of those prior published applications is incorporated herein by reference in their entirety. The tanks disclosed in AU 2017200217 and AU2010286347 are pre-engineered and require no footings making them a cost-effective way of storing water or other liquids while hidden away as a retaining wall, front fence or pool and pergola surround. They may also incorporate a planter top for growing plants and shrubs, or other top/flat structure as required.

10 [0044] The tanks of AU 2017200217 and AU2010286347 are storage devices of predetermined sizes that may be rectangular and placed end to end or side by side or at right angles to each other and joined contiguously or coupled together via pipes/conduits in various configurations for endless storage capacity. They are not restricted to use as retaining walls and may be free standing as well as being set in or
15 underground as required.

[0045] It is envisaged in accordance with embodiments of the present invention that the tanks of AU 2017200217 and AU2010286347, modified in accordance with the present invention, may be utilised as one or a combination of:

- A standalone OSD system;
- 20 • A stand-alone OSD system incorporating a HED storage unit;
- A stand-alone OSD system incorporating a trash pit and HED unit in one structure;
- A retaining wall structure and OSD system combined;
- A front fence or pool surround or pergola surround and OSD system combined;
- 25 • A water/liquid storage reservoir and OSD system combined;
- A water treatment liquid storage system;
- An oil reclamation and treatment system.

[0046] As noted, these tanks are modular and pre-engineered for use on most construction and development sites for huge cost savings over in situ fixed construction. The tanks may have a flat top located at the top of the storage reservoir or incorporate a planter top sitting on top of the reservoir. The planter top may also sit on a ridge or recess located on the inside of the liquid storage reservoir walls. The planter top and/or flat top may incorporate access points of any nature including man holes for cleaning and servicing. Internal steps may also be fitted internally to aid the cleaning process.

[0047] In another aspect of preferred embodiments of the invention involving a contiguous configuration of a plurality of adjoined tanks, the tanks' combined liquid storage reservoir may also combine to be a retaining wall structure incorporating half the retaining wall as a water storage reservoir and the other half as an OSD system. This may be achieved by having the water storage reservoir for say the first two or three tanks (depending upon capacity required) in the retaining wall system and the balance of the retaining wall as the OSD system. At the same time the integrity and retaining wall structure and pleasant appearance may be maintained.

[0048] An alternate way of combining a water storage reservoir and OSD system is to have the lower level of the bank of tanks as the water storage reservoir and the top area as the OSD system. When the water level in the reservoir reaches a predetermined height the water flows to stormwater or is discharged leaving the water height at required level and full capacity in the storage portion.

[0049] Whilst embodiments of the present invention are applicable for use in underground detention and storage, it is considered that above ground detention and water storage is more cost effective and may be easier to design, particularly with respect to the modular aspects of the present invention, which provide a useful solution for above ground OSD. With further respect to underground detention systems there can be a real issue if the slope of the land on a particular site is toward the back and council infrastructure (stormwater) piping is at the front of the property. In this instance, the OSD system needs to be pumped to the council piping and an emergency backup power supply will be required in this case. Furthermore, it is difficult, if not impossible to know exactly what will be encountered once digging starts at a site and rock may be found with huge costs to remove it. Soil testing is an option

but becomes an additional cost. With reference to a number of the accompanying drawings, it is evident that in addressing such issues, embodiments of the present invention can also be used such that the tank configuration is up to 90% or more submerged underground if required but not down deep, leaving the upper ends of the tanks, for example a planter top, out of ground.

[0050] It has been considered by the inventor that the tanks of AU 2017200217 and AU2010286347 may be configured together to store water and release it slowly. However, it has been noted that a number of issues need to be overcome in order to provide a useful detention system. In particular, the ability to provide a HED device and the ability to take water from hard surfaces such as concrete, especially when these tanks are most suited for their use when disposed above ground.

[0051] With reference to Figure 1, a modified tank is shown that incorporates, inter alia, an inbuilt refuse pit and a slotted aperture for allowing ingress of storm and waste water. Alternatively, input to the tank may be accommodated by way of a pipe or conduit and examples of this are shown in any of Figures 9 or 11. With reference to Figures 5, 6 and 19 a bank of tanks is shown where the modified tank incorporating an inbuilt refuse pit is placed as the first tank of a row of tanks and this first tank also becomes the HED unit for the purposes of providing an OSD system as well as a retaining wall or front fence structure. The number of tanks in a system will be determined by the amount of water required to accommodate the consumers OSD requirements. The first HED tank overflows when full into the other tanks, which act as the bulk liquid storing device. The water from the HED tank is not allowed to flow into the other storage devices until the HED tank is full. As shown in Figure 19 the HED tank, ie tank No 1 in the bank includes a small orifice on the side to allow the water from this tank to drain to stormwater in accordance with its function as an OSD system.

[0052] The HED unit in such a modular fluid management system as illustrated in Figures 5, 6 and 19 is configured to accept storm water from a roof or run off from hard surfaces. Figure 8 illustrates a similar system using the modified tank of Figure 1 as the HED unit in a driveway. Figures 7 and 8 illustrate the tanks' function as a fence or retaining wall. This is a tidy arrangement and removes the necessity of a builder, engineer or designer to "match up" their pits and sizes to suit their system on

- site. The HED tank allows for a more accurate discharge rate of water to be calculated in that it fills up first and when full overflows into the second tank or bank of tanks. The purpose here is to allow engineers to calculate accurately how much water they should discharge to stormwater during a storm as this tank will nominally
- 5 always be full. When the HED tank is full it overflows into other secondary tanks in the bank as required in any number thereof. The first tank fills quickly and discharges the stormwater at a given rate based on the amount of water in that first tank. The first tank may be full and discharging to stormwater before the storage reservoir tanks even have received any water. They may be empty usually at the beginning of a
- 10 storm event until the HED tank fills and overflows into these secondary chambers. Once the first 'HED' tank begins to discharge to stormwater at a given rate the HED tank will also drain to a lower level equalising the levels to that of the secondary reservoir tanks when the reservoir tanks will then drain (under control see below) into the HED tank as the hydraulic pressure will have equalised.
- 15 [0053] These other tanks in the bank receive the overflow water from the HED and hold it until the water level in the HED tank falls to their level when the water flow will reverse back into the HED tank again and to stormwater through a control orifice. When the HED tank is filling, water is prevented from flowing into the secondary tanks by using a check valve in the HED at the lower level while the overflow at the top
- 20 allows the water to flow into secondary tanks for storage. The HED tank has a one-way check valve fitting to prevent water flowing into the reservoir tanks until the first HED tank is full. This ensures the restricted discharge rate is correct as calculated by engineers. All the tanks may have an orifice with one way check valves fitted and incorporated into the lower part of the tank to allow the bulk storage water to flow
- 25 back into the HED once the HED tank begins to fall below the water level of the storage tanks. This one-way valve may be serviced using a PVC threaded coupling, of any size or man hole through the planer top to access any of the liquid storage reservoirs for maintenance.
- [0054] Once a storm has passed and discharge from the HED tank is to a lower
- 30 level, water from the secondary storage tanks is allowed to flow into the HED tank and out to stormwater through a control orifice until all tanks in the bank are empty.

The check valve prevents the storage reservoirs from receiving water from the HED tank until that tank was full.

5 [0055] The HED unit may also encompass a refuse pit to receive contaminated liquid and filter those contaminants, trash etc, through a mesh prior to flowing into a HED storage chamber. The mesh filter is preferably incorporated into a baffle in the HED tank. The trash pit may also have a mosquito or bug proof top fitted to the top, which may be placed anywhere in the HED tank and secured as appropriate. Access to the HED tank is preferably through the planter top but may be accessed directly to the tank if the planter top is not incorporated into the system or a flat top is used.

10 [0056] The inbuilt pit may be constructed into a recess cast into the side walls of the first or second tank with a separating baffle placed anywhere along the side of the tank as required for total pit capacity and filtering requirement. This baffle may be all mesh or part mesh to suit design and contaminant load requirements.

15 [0057] In another embodiment, it is possible to have the entire first tank as the refuse pit if required and the second tank as the HED unit, based on capacities and flow rates required. Moreover, it is envisaged that any tank from the bank of tanks could be the refuse pit and deliver water to a separate HED tank operating in the same way as above. The mesh filter in refuse pit will need to be adapted to suit.

20 [0058] In the modular design of embodiments, plumbing orifices may be placed anywhere in any of the tank storage reservoirs to suit the application for accommodating fluid flow. For example, all the tanks in the system may have an orifice at the top and bottom of the tanks to receive and discharge water either within them or to storm water as water flow requires. This orifice will usually be around about 100mm to about 150mm but can be any size as would be appreciated by the
25 person skilled in the art. The discharge to stormwater-restricted orifice in the HED tank is typically around 40mm but again, as would be appreciated by the skilled reader, may be any size.

30 [0059] Each of the tanks in the system may have multiple inlets and outlet pipes to suit any installation and this includes any dual purpose OSD/retention systems. In this respect, if tanks of the management system are used as a retaining wall it may be this is in part, such that half the wall is a storage tank and the other half is a OSD

system. By way of example, in an exemplary system, the entire first or second tanks are converted into a refuse pit in its own right with a fully removable top for those tanks independent of the other tank(s). This may be for when contaminants are expected to be severe.

- 5 [0060] It is possible to mix and match the location of any of the tanks in the structure to achieve desired results for OSD and/or water retention. By way of example, the HED tank may also be an entire tank in a bank or even two tanks (or more) in a bank in a larger system. These HED tanks could deliver water/liquid to the storage reservoir tanks in or from any direction. In this respect, Figure 17 shows an
10 example where a HED tank is situated in between reservoir storage tanks. Accordingly, the HED tank and other storage tanks in the system can be adapted to receive liquid from any source and any number of orifices for inflow and overflow.

- [0061] The refuse pit is primarily for use when hard surface water such as that coming from a driveway is required to form part of the OSD system. The pit is
15 designed to collect rubbish, stones and gravel and act as a silt pit, where silt may settle and be removed later. Roof water or other liquid may also be directed into the pit as required. The refuse pit, whether it is a portion of a tank or the entire tank, may incorporate a round pipe, round orifice or a slot, for the water to flow in from the road way or hard surface and may incorporate an orifice of any size or shape for
20 connecting pipes to the system.

[0062] The refuse pit, as incorporated into a tank, may also receive water from another pit in any location around the property. The pit may be of any size and, as noted above, may even take up the entire capacity of the first tank (or even second tank) in a retaining wall or front fence system.

- 25 [0063] The pit may have a full basket built in to collect waste for easy removal of refuse and cleaning. It may also have an internal wall or several internal walls, partly solid and partly with a mesh at the top or bottom to allow the water to flow into the reservoir and on to the other tanks in the system. The internal wall may also be all mesh if required.

- 30 [0064] Figure 14 illustrates an example modular tank unit adapted for both retention and OSD function. The tank of Figure 14 may hold water from its bottom to

a water storage level where the water in the lower portion of the tank remains as water storage for use by the property owner. When storm water reaches a certain higher level, it is discharges to storm water outlet at a predetermined rate as required. Larger inflow and outflow pipes are shown at the side of the tank. At the end of the tank the storm water outlet orifice is situated at the higher level and there is a pump outlet below this for the water storage outlet. Notably, this system is only suitable for roof collected water.

[0065] An alternate means for the dual function of OSD and water retention/storage, with the above description of embodiments in mind, a subset of contiguous tanks in a bank may be employed for OSD while a reminder subset of tanks may be used for retention. The full bank of tanks may form an integral retainer wall but at the junction between the functioning units they may not be in fluid connection to separate the two functions.

[0066] Most building sites have some form of incline where retaining walls may be required and as such a traditional OSD system may not be required, saving many tens of thousands of dollars for the property owner. In this case, the stormwater runoff from the hard surfaces may be directed to the bank of tanks in preferred embodiments at a strategic location for best results. Figures 7 an 8 illustrate this scenario. This arrangement may apply to any water/liquid storage requirement for use as a triple interceptor.

[0067] The first and/or second and third tanks in the system may be plumbed to become HED tanks in combination with each other on larger sites. Utilising the modular tanks of the management system in this manner eliminates much of the design work for engineers and architects and makes their job easier. It removes an element of risk and helps standardise the construction eliminating difficult and technical structural elements to building an OSD system. The tanks may be above or below ground to suit site conditions.

[0068] Whilst an exemplary function for this attractive solution is for water/liquid storage and or OSD requirements combined, it also has application to be used as a filtration device for contaminated water, (sewage) liquid or oil or in the management of

any other fluid contaminant(s). Figure 16a illustrates a modified tank unit configured to be suitable for the treatment and filtration processes described here and below.

[0069] Such an application may see use at remote dwellings where town sewage is not available, at power sub stations, power generating stations, service stations, food service establishments, engineering works and switching boxes all using large amounts of substances such as oil and other liquids subject to spillage.

[0070] For this use, additional baffles may be inserted into first, second or third tanks as required but the tanks in themselves act as a device ideal for filtration treatment and water purification. The baffles in vertical or horizontal disposition may be in membrane form of any material such as concrete, mesh, anode, cathodes to aid in the purification process. By way of example, the first tank in the row will receive the contaminated water and trap the largest particles in it refuse pit. This partly clean water then flows into the next storage chamber. The next chamber may either be a baffle segment or the tank itself may be that chamber. Separating chambers may be hollow or incorporate a storage area for filtration and separation of materials to be incorporated into the system.

[0071] It is envisaged that the modular tanks placed in a row or at right angles and as another structure may all act as one effective filtration and waste water treatment plant or process. Traditionally the first tank deals with the larger particulates and bulk of the contaminants. The second and third tanks may have a filtration system incorporating varying gauge mesh segments to further remove particulates and as such helps to remove TDS (Total Dissolved Solids). The tanks following tank 1 may have a wide and varying degree of functions from removing oil via ultra-filtration or vortex function to dosing to remove TDS and reduce BOD (Biological Oxygen Demand).

[0072] Each tank in sequence performs its assigned process and when finished the fluid and/or liquid passes to the next tank for further processing until at the end of the chain all the liquids have had the contaminants removed and may be dosed with biocide to remove bacteria and other undesirables as required. It can be expected that a range of non-proprietary equipment may be used in each of these processes to achieve desired results.

[0073] Access to the equipment in the tanks themselves will be through the planter (or flatbed) with door or manhole attached. It is possible to have the flat top of the tanks as the full access point into the reservoirs below.

5 [0074] The tanks towards the end of the row may also act as water gardens and micro filtration systems where varying grades of gravel and sand (and membranes) are used to handle the final cleansing of the liquid prior to despatch. These water gardens at the end of the process may also have biological agents used as part of the final cleaning process. Biological agents may be used in a variety of different forms to achieve desired results.

10 [0075] This system also lends itself to Aerobic treatment where air is pumped through the contaminated fluid to encourage biological activity, for example, to “eat” the sewage. Oxygen rich water is also biocidal in its own right and may be utilised. The internal baffles may be vertical or horizontal as required for the filtration system.

15 [0076] As a further embodiment and general purpose liquid treatment system it is possible to have an “Open vented system” as exemplified in Figure 10 where the inflow of water flows past the tanks which have an underside elbow to receive water into each of the tanks and allow any surplus liquid to flow to stormwater or waste.

20 [0077] When the storage reservoirs are full the overflow is then directed to a manifold, which takes surplus liquid and directs it to the same inflow piping at the end of the system. This prevents overloading of the system in the event of a 1/100 year storm event or other heavy liquid spillage.

[0078] Example protocols for both waste water treatment and oil removal in accordance with exemplary embodiments follow.

25 [0079] In a basic waste water treatment the individual modular tanks may be of any desired size and there may be as many tanks employed as considered suitable. The protocol would be as follows:

- Tank 1 or any number of tanks to suit, receives effluent and acts as a trash pit to collect solids such as cotton buds and wipes.

- Tanks may have several baffles and mesh filters to assist with treatment process.
- It is envisaged mesh filters will have large gauge reducing to smaller gauge (hole size) as the process progresses.
- 5 • Cleaning trash from the tanks/liquid storage device is through planter top or flat top with access door as previously.
- Alternatively trash may be directed to an area using a funnel device or similar for remote removal.
- Tanks may be above or below ground.
- 10 • All tanks are joined together in using an orifice of any size placed anywhere that suits.
- Effluent from each tank may overflow into next tank if required for effect.
- Tanks may also form any configuration to suit.
- 15 • Tank 2, 3 and 4 or any number of tanks as required receives water from tank 1 through the use of an orifice and seal joining the two tanks together. Orifice and seal may be located anywhere in structure to suit.
- These tanks 2, 3 and 4 or as many tanks as required, acts as settlement tanks to separate organic matter from the liquid. This may be done using a variety of common practices such as flocking and time based processing.
- 20 • This process reduces BOD and TDC.
- Sludge then settles on the bottom of the tank and is available for vacuuming out for further processing. This cleaning may also be done remotely as all sludge is directed to a given point for removal and further treatment. (Drying)
- 25 • Tank 5 and any subsequent tanks contains aeration equipment where air is pumped through solution to aid bacterial action to further break-down solution and finer sludge is formed.

- The water/solution at this point is almost free from bacterial contamination.
 - Tank 6 and any subsequent tanks may contain further filtration equipment of be a sand receptacle to hold gravel and sand to remove finer particulates. This tank and subsequent tanks may be backwashed as required to remove fine sediment for further treatment (drying)
 - Tank 7 and subsequent tanks will house a chemical dosing mechanism to deliver biocide to final solution as required.
 - Using the tank units in this manner and as a retaining wall reduces costs and makes the many stage treatment process more effective.
- 10 [0080] In an oil removal process the individual modular tanks may be of any desired size and there may be as many tanks employed as considered suitable. The protocol would be as follows:
- Tank 1 or any number of tanks to suit, receives contaminate with potential solids.
 - Tanks may have several baffles and mesh filters to assist with treatment process.
 - It is envisaged mesh filters will have large gauge reducing to smaller gauge (hole size) as the process progresses.
 - Cleaning trash from the tanks/liquid storage device is through planter top or flat top with access door as previously.
 - Alternatively, trash may be directed to an area using a funnel device or similar for remote removal.
 - Tanks may be above or below ground.
 - All tanks are joined together in using an orifice of any size placed anywhere that suits.
 - Effluent from each tank may overflow into next tank if required for effect.

- Tanks may also form any configuration to suit.
 - Tanks may be configured to receive contaminated liquid as required.
 - Each tank may encompass its own oil separator equipment in a staged process.
- 5
- Tank 2, 3 and 4 or any number of tanks as required receives liquid from tank 1 through the use of an orifice and seal joining the two tanks together. Orifice and seal may be located anywhere in structure to suit.
 - These tanks 2, 3 and 4 or as many tanks as required, acts as further oil separation/settlement tanks
- 10
- This may be done using a variety of common practices such as chemical dosing or membrane technologies including flocking and time based processing.
 - This process reduces BOD and TDC.
- 15
- Sludge then settles on the bottom of the tank and is available for vacuuming out for further processing. This cleaning may also be done remotely as all sludge is directed to a given point for removal and further treatment. (Drying)
 - Tank 5 and any subsequent tanks contains aeration equipment where air is pumped through solution to aid bacterial action to further breakdown solution and finer sludge is formed.
- 20
- The contaminated liquid solution at this point is almost free from contamination.
 - Tank 6 and any subsequent tanks may contain further filtration equipment of be a sand receptacle to hold gravel/sand/membranes to remove finer particulates. This tank and subsequent tanks may be backwashed as required to remove fine sediment for further treatment (drying)
- 25
- Using the tank modules in this manner and as a retaining wall reduces costs and makes the many stage treatment process more effective.

- The system may be buried as required but system broken down into segments makes for more efficient processing.

[0081] While this invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification(s).

5 This application is intended to cover any variations uses or adaptations of the invention following in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice within the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth.

10 [0082] As the present invention may be embodied in several forms without departing from the spirit of the essential characteristics of the invention, it should be understood that the above described embodiments are not to limit the present invention unless otherwise specified, but rather should be construed broadly within the spirit and scope of the invention as defined in the appended claims. The
15 described embodiments are to be considered in all respects as illustrative only and not restrictive.

[0083] Various modifications and equivalent arrangements are intended to be included within the spirit and scope of the invention and appended claims. Therefore, the specific embodiments are to be understood to be illustrative of the many ways in
20 which the principles of the present invention may be practiced. In the following claims, means-plus-function clauses are intended to cover structures as performing the defined function and not only structural equivalents, but also equivalent structures. For example, although a nail and a screw may not be structural equivalents in that a nail employs a cylindrical surface to secure wooden parts together, whereas a screw
25 employs a helical surface to secure wooden parts together, in the environment of fastening wooden parts, a nail and a screw are equivalent structures.

[0084] The following sections I – VII provide a guide to interpreting the present specification.

I. Terms

[0085] The term "product" means any machine, manufacture and/or composition of matter, unless expressly specified otherwise.

[0086] The term "process" means any process, algorithm, method or the like, unless expressly specified otherwise.

5 [0087] Each process (whether called a method, algorithm or otherwise) inherently includes one or more steps, and therefore all references to a "step" or "steps" of a process have an inherent antecedent basis in the mere recitation of the term 'process' or a like term. Accordingly, any reference in a claim to a 'step' or 'steps' of a process has sufficient antecedent basis.

10 [0088] The term "fluid" is to be taken as including but not limited to one or a combination of liquids, semi-liquids, slurries, and liquids containing solids and/or particulates. One exemplary fluid would be storm water, which includes debris and trash in a flowing water mass. Another example fluid would be sewage.

[0089] In the context of onsite water management, the term "detention" refers to
15 the collection of rain water during a storm and its release slowly during and after the storm. The term "retention" refers to water being held on site and possibly treated or used for other purposes.

[0090] The term "invention" and the like mean "the one or more inventions disclosed in this specification", unless expressly specified otherwise.

20 [0091] The terms "an embodiment", "embodiment", "embodiments", "the embodiment", "the embodiments", "one or more embodiments", "some embodiments", "certain embodiments", "one embodiment", "another embodiment" and the like mean "one or more (but not all) embodiments of the disclosed invention(s)", unless expressly specified otherwise.

25 [0092] The term "variation" of an invention means an embodiment of the invention, unless expressly specified otherwise.

[0093] A reference to "another embodiment" in describing an embodiment does not imply that the referenced embodiment is mutually exclusive with another

embodiment (e.g., an embodiment described before the referenced embodiment), unless expressly specified otherwise.

[0094] The terms “including”, “comprising” and variations thereof mean “including but not limited to”, unless expressly specified otherwise.

5 [0095] The terms “a”, “an” and “the” mean “one or more”, unless expressly specified otherwise.

[0096] The term “plurality” means “two or more”, unless expressly specified otherwise.

10 [0097] The term “herein” means “in the present specification, including anything which may be incorporated by reference”, unless expressly specified otherwise.

[0098] The phrase “at least one of”, when such phrase modifies a plurality of things (such as an enumerated list of things), means any combination of one or more of those things, unless expressly specified otherwise. For example, the phrase “at least one of a widget, a car and a wheel” means either (i) a widget, (ii) a car, (iii) a wheel, (iv) a widget and a car, (v) a widget and a wheel, (vi) a car and a wheel, or (vii) a widget, a car and a wheel. The phrase “at least one of”, when such phrase modifies a plurality of things, does not mean “one of each of” the plurality of things.

15

[0099] Numerical terms such as “one”, “two”, etc. when used as cardinal numbers to indicate quantity of something (e.g., one widget, two widgets), mean the quantity indicated by that numerical term, but do not mean at least the quantity indicated by that numerical term. For example, the phrase “one widget” does not mean “at least one widget”, and therefore the phrase “one widget” does not cover, e.g., two widgets.

20

[00100] The phrase “based on” does not mean “based only on”, unless expressly specified otherwise. In other words, the phrase “based on” describes both “based only on” and “based at least on”. The phrase “based at least on” is equivalent to the phrase “based at least in part on”.

25

[00101] The term “represent” and like terms are not exclusive, unless expressly specified otherwise. For example, the term “represents” do not mean “represents only”, unless expressly specified otherwise. In other words, the phrase “the data

represents a credit card number" describes both "the data represents only a credit card number" and "the data represents a credit card number and the data also represents something else".

5 [00102] The term "whereby" is used herein only to precede a clause or other set of words that express only the intended result, objective or consequence of something that is previously and explicitly recited. Thus, when the term "whereby" is used in a claim, the clause or other words that the term "whereby" modifies do not establish specific further limitations of the claim or otherwise restricts the meaning or scope of the claim.

10 [00103] The term "e.g." and like terms mean "for example", and thus does not limit the term or phrase it explains. For example, in the sentence "the computer sends data (e.g., instructions, a data structure) over the Internet", the term "e.g." explains that "instructions" are an example of "data" that the computer may send over the Internet, and also explains that "a data structure" is an example of "data" that the
15 computer may send over the Internet. However, both "instructions" and "a data structure" are merely examples of "data", and other things besides "instructions" and "a data structure" can be "data".

[00104] The term "i.e." and like terms mean "that is", and thus limits the term or phrase it explains. For example, in the sentence "the computer sends data (i.e.,
20 instructions) over the Internet", the term "i.e." explains that "instructions" are the "data" that the computer sends over the Internet.

[00105] Any given numerical range shall include whole and fractions of numbers within the range. For example, the range "1 to 10" shall be interpreted to specifically include whole numbers between 1 and 10 (e.g., 2, 3, 4, . . . 9) and non-whole
25 numbers (e.g., 1.1, 1.2, . . . 1.9).

II. Determining

[00106] The term "determining" and grammatical variants thereof (e.g., to determine a price, determining a value, determine an object which meets a certain criterion) is used in an extremely broad sense. The term "determining" encompasses a wide
30 variety of actions and therefore "determining" can include calculating, computing,

processing, deriving, investigating, looking up (e.g., looking up in a table, a database or another data structure), ascertaining and the like. Also, "determining" can include receiving (e.g., receiving information), accessing (e.g., accessing data in a memory) and the like. Also, "determining" can include resolving, selecting, choosing, establishing, and the like.

[00107] The term "determining" does not imply certainty or absolute precision, and therefore "determining" can include estimating, extrapolating, predicting, guessing and the like.

[00108] The term "determining" does not imply that mathematical processing must be performed, and does not imply that numerical methods must be used, and does not imply that an algorithm or process is used.

[00109] The term "determining" does not imply that any particular device must be used. For example, a computer need not necessarily perform the determining.

III. Indication

[00110] The term "indication" is used in an extremely broad sense. The term "indication" may, among other things, encompass a sign, symptom, or token of something else.

[00111] The term "indication" may be used to refer to any indicia and/or other information indicative of or associated with a subject, item, entity, and/or other object and/or idea.

[00112] As used herein, the phrases "information indicative of" and "indicia" may be used to refer to any information that represents, describes, and/or is otherwise associated with a related entity, subject, or object.

[00113] Indicia of information may include, for example, a symbol, a code, a reference, a link, a signal, an identifier, and/or any combination thereof and/or any other informative representation associated with the information.

[00114] In some embodiments, indicia of information (or indicative of the information) may be or include the information itself and/or any portion or component

of the information. In some embodiments, an indication may include a request, a solicitation, a broadcast, and/or any other form of information gathering and/or dissemination.

IV. Forms of Sentences

5 [00115] Where a limitation of a first claim would cover one of a feature as well as more than one of a feature (e.g., a limitation such as **"at least one widget"** covers one widget as well as more than one widget), and where in a second claim that depends on the first claim, the second claim uses a definite article **"the"** to refer to the limitation (e.g., **"the widget"**), this does not imply that the first claim covers only one of the
10 feature, and this does not imply that the second claim covers only one of the feature (e.g., **"the widget"** can cover both one widget and more than one widget).

[00116] When an ordinal number (such as **"first"**, **"second"**, **"third"** and so on) is used as an adjective before a term, that ordinal number is used (unless expressly specified otherwise) merely to indicate a particular feature, such as to distinguish that
15 particular feature from another feature that is described by the same term or by a similar term. For example, a **"first widget"** may be so named merely to distinguish it from, e.g., a **"second widget"**. Thus, the mere usage of the ordinal numbers **"first"** and **"second"** before the term **"widget"** does not indicate any other relationship between the two widgets, and likewise does not indicate any other characteristics of either or
20 both widgets. For example, the mere usage of the ordinal numbers **"first"** and **"second"** before the term **"widget"** (1) does not indicate that either widget comes before or after any other in order or location; (2) does not indicate that either widget occurs or acts before or after any other in time; and (3) does not indicate that either widget ranks above or below any other, as in importance or quality. In addition, the
25 mere usage of ordinal numbers does not define a numerical limit to the features identified with the ordinal numbers. For example, the mere usage of the ordinal numbers **"first"** and **"second"** before the term **"widget"** does not indicate that there must be no more than two widgets.

[00117] When a single device or article is described herein, more than one
30 device/article (whether or not they cooperate) may alternatively be used in place of the single device/article that is described. Accordingly, the functionality that is

described as being possessed by a device may alternatively be possessed by more than one device/article (whether or not they cooperate).

5 [00118] Similarly, where more than one device or article is described herein (whether or not they cooperate), a single device/article may alternatively be used in place of the more than one device or article that is described. For example, a plurality of computer-based devices may be substituted with a single computer-based device. Accordingly, the various functionality that is described as being possessed by more than one device or article may alternatively be possessed by a single device/article.

10 [00119] The functionality and/or the features of a single device that is described may be alternatively embodied by one or more other devices which are described but are not explicitly described as having such functionality/features. Thus, other embodiments need not include the described device itself, but rather can include the one or more other devices which would, in those other embodiments, have such functionality/features.

15 V. Disclosed Examples and Terminology Are Not Limiting

[00120] Neither the Title nor the Abstract in this specification is intended to be taken as limiting in any way as the scope of the disclosed invention(s). The title and headings of sections provided in the specification are for convenience only, and are not to be taken as limiting the disclosure in any way.

20 [00121] Numerous embodiments are described in the present application, and are presented for illustrative purposes only. The described embodiments are not, and are not intended to be, limiting in any sense. The presently disclosed invention(s) are widely applicable to numerous embodiments, as is readily apparent from the disclosure. One of ordinary skill in the art will recognise that the disclosed
25 invention(s) may be practised with various modifications and alterations, such as structural, logical, software, and electrical modifications. Although particular features of the disclosed invention(s) may be described with reference to one or more particular embodiments and/or drawings, it should be understood that such features are not limited to usage in the one or more particular embodiments or drawings with
30 reference to which they are described, unless expressly specified otherwise.

[00122] The present disclosure is not a literal description of all embodiments of the invention(s). Also, the present disclosure is not a listing of features of the invention(s) which must be present in all embodiments.

5 [00123] Devices that are described as in communication with each other need not be in continuous communication with each other, unless expressly specified otherwise. On the contrary, such devices need only transmit to each other as necessary or desirable, and may actually refrain from exchanging data most of the time. For example, a machine in communication with another machine via the Internet may not transmit data to the other machine for long period of time (e.g. weeks
10 at a time). In addition, devices that are in communication with each other may communicate directly or indirectly through one or more intermediaries.

[00124] A description of an embodiment with several components or features does not imply that all or even any of such components/features are required. On the contrary, a variety of optional components are described to illustrate the wide variety
15 of possible embodiments of the present invention(s). Unless otherwise specified explicitly, no component/feature is essential or required.

[00125] Although process steps, operations, algorithms or the like may be described in a particular sequential order, such processes may be configured to work in different orders. In other words, any sequence or order of steps that may be
20 explicitly described does not necessarily indicate a requirement that the steps be performed in that order. The steps of processes described herein may be performed in any order practical. Further, some steps may be performed simultaneously despite being described or implied as occurring non-simultaneously (e.g., because one step is described after the other step). Moreover, the illustration of a process by its depiction
25 in a drawing does not imply that the illustrated process is exclusive of other variations and modifications thereto, does not imply that the illustrated process or any of its steps are necessary to the invention(s), and does not imply that the illustrated process is preferred.

[00126] Although a process may be described as including a plurality of steps, that
30 does not imply that all or any of the steps are preferred, essential or required. Various other embodiments within the scope of the described invention(s) include

other processes that omit some or all of the described steps. Unless otherwise specified explicitly, no step is essential or required.

5 [00127] Although a process may be described singly or without reference to other products or methods, in an embodiment the process may interact with other products or methods. For example, such interaction may include linking one business model to another business model. Such interaction may be provided to enhance the flexibility or desirability of the process.

10 [00128] Although a product may be described as including a plurality of components, aspects, qualities, characteristics and/or features, that does not indicate that any or all of the plurality are preferred, essential or required. Various other embodiments within the scope of the described invention(s) include other products that omit some or all of the described plurality.

15 [00129] An enumerated list of items (which may or may not be numbered) does not imply that any or all of the items are mutually exclusive, unless expressly specified otherwise. Likewise, an enumerated list of items (which may or may not be numbered) does not imply that any or all of the items are comprehensive of any **category, unless expressly specified otherwise. For example, the enumerated list “a computer, a laptop, a PDA”** does not imply that any or all of the three items of that list are mutually exclusive and does not imply that any or all of the three items of that list
20 are comprehensive of any category.

[00130] An enumerated list of items (which may or may not be numbered) does not imply that any or all of the items are equivalent to each other or readily substituted for each other.

25 [00131] All embodiments are illustrative, and do not imply that the invention or any embodiments were made or performed, as the case may be.

[00132] Where a process is described, in an embodiment the process may operate without any user intervention. In another embodiment, the process includes some human intervention (e.g., a step is performed by or with the assistance of a human).

CLAIMS:

1. An onsite fluid management system comprising one or a combination of predetermined sized tanks configured to form a structural formation, the structural formation comprising:

an inlet for unprocessed fluid;

a flow control chamber adapted to limit discharge of fluid to a drainage outlet at a predetermined discharge flow rate;

a storage reservoir for receiving excess discharge from the flow control chamber and adapted for equalised flow back to the flow control chamber wherein the equalised flow is limited to the predetermined discharge flow rate.

2. An onsite fluid management system as claimed in claim 1 wherein one or a combination of the inlet and the flow control chamber includes a refuse pit for collection of waste from the unprocessed inlet fluid.

3. An onsite fluid management system as claimed in claim 2 wherein the inlet, the flow control chamber, the storage reservoir or the refuse pit are formed by one of:

a tank;

a part of a tank or;

a plurality of tanks.

4. An onsite fluid management system as claimed in any previous claim wherein the structural formation comprises one or a combination of:

a retainer wall;

a pool;

a pergola;

a fence;

a wall.

5. A tank unit for a modular onsite fluid management system adapted to receive unprocessed fluid, the tank unit comprising:
 - a first part forming a refuse pit for collection of waste from the unprocessed fluid;
 - a second part forming a flow control chamber adapted to limit discharge of fluid to a drainage outlet at a predetermined discharge flow rate;
 - a baffle separating the first and second parts; and
 - a connection to a storage reservoir.
6. A method or protocol as herein described.
7. A system, device or apparatus as herein described.

1/18

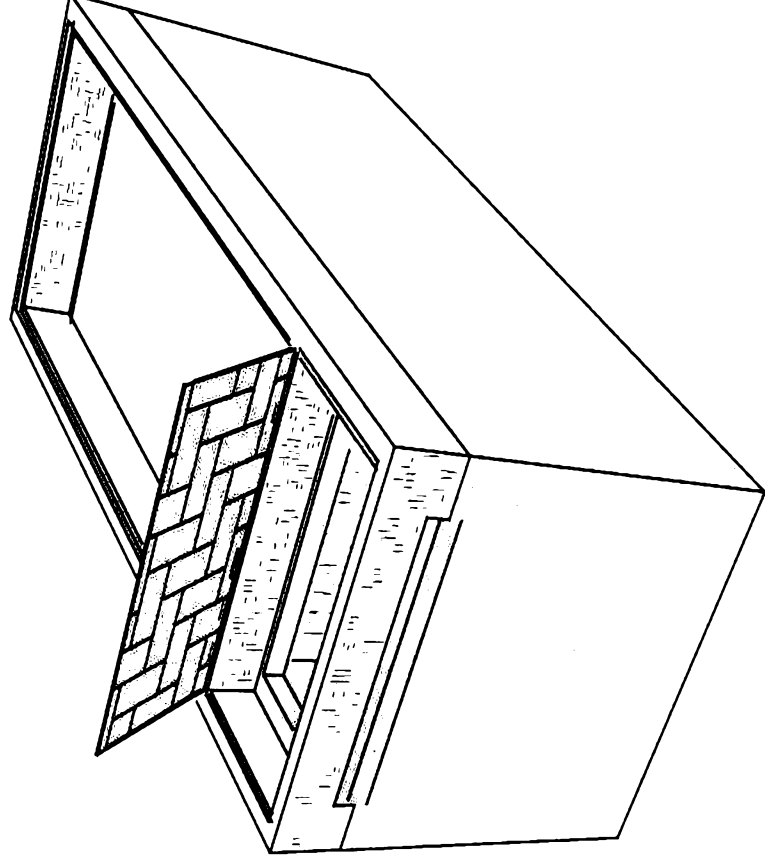


Figure 1

2/18

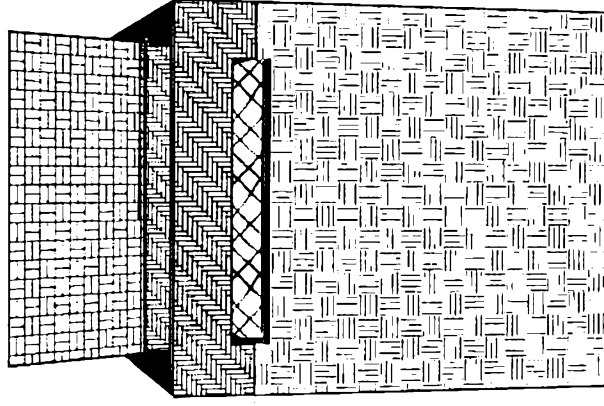


Figure 2

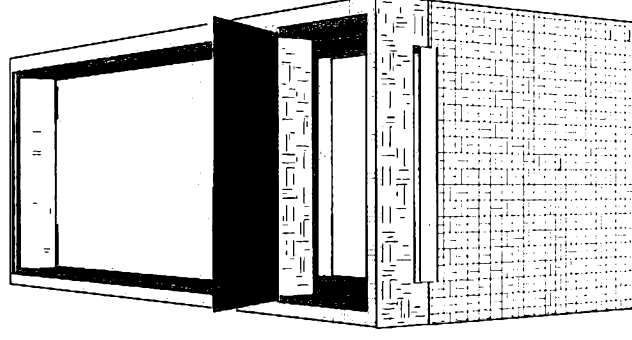


Figure 3

3/18

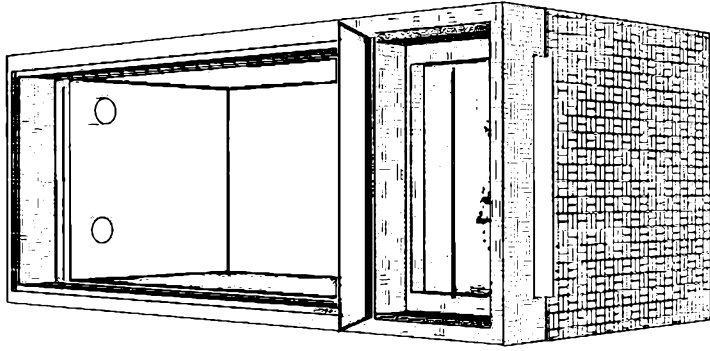


Figure 4

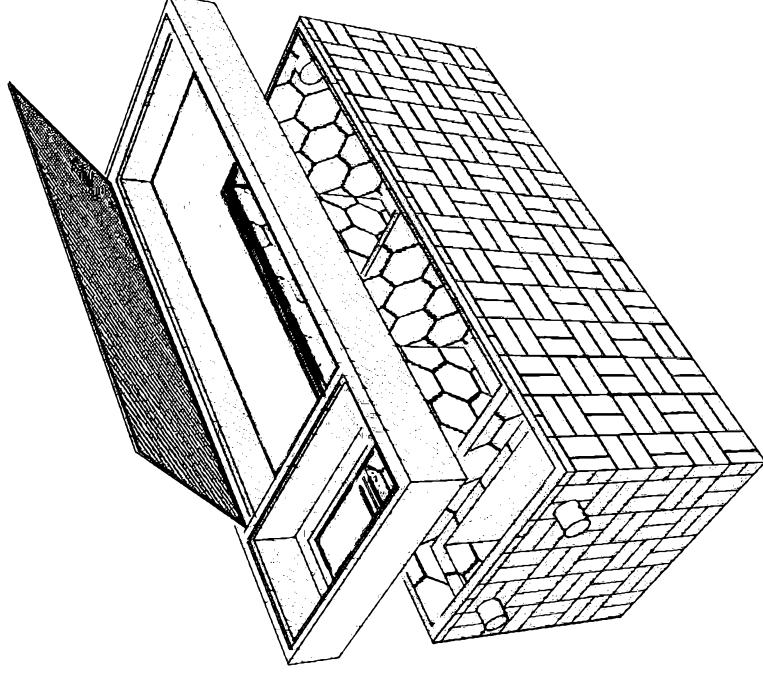


Figure 9

4/18

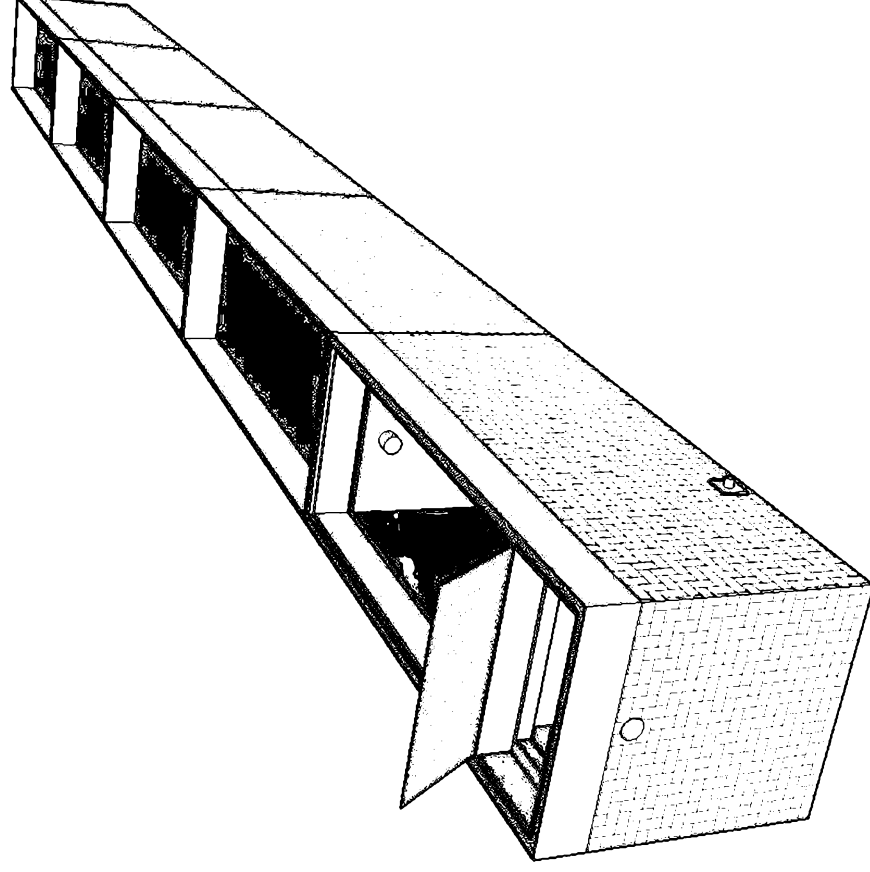


Figure 5

5/18

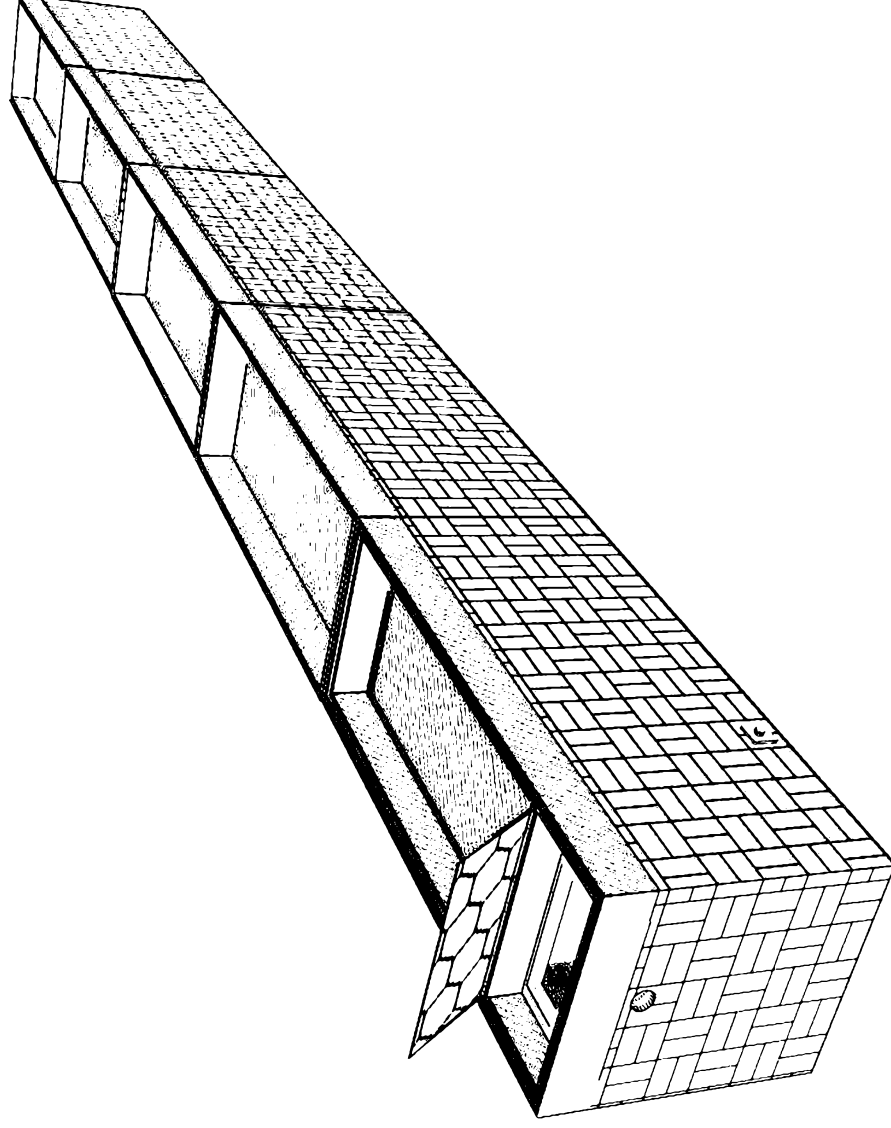


Figure 6

6/18

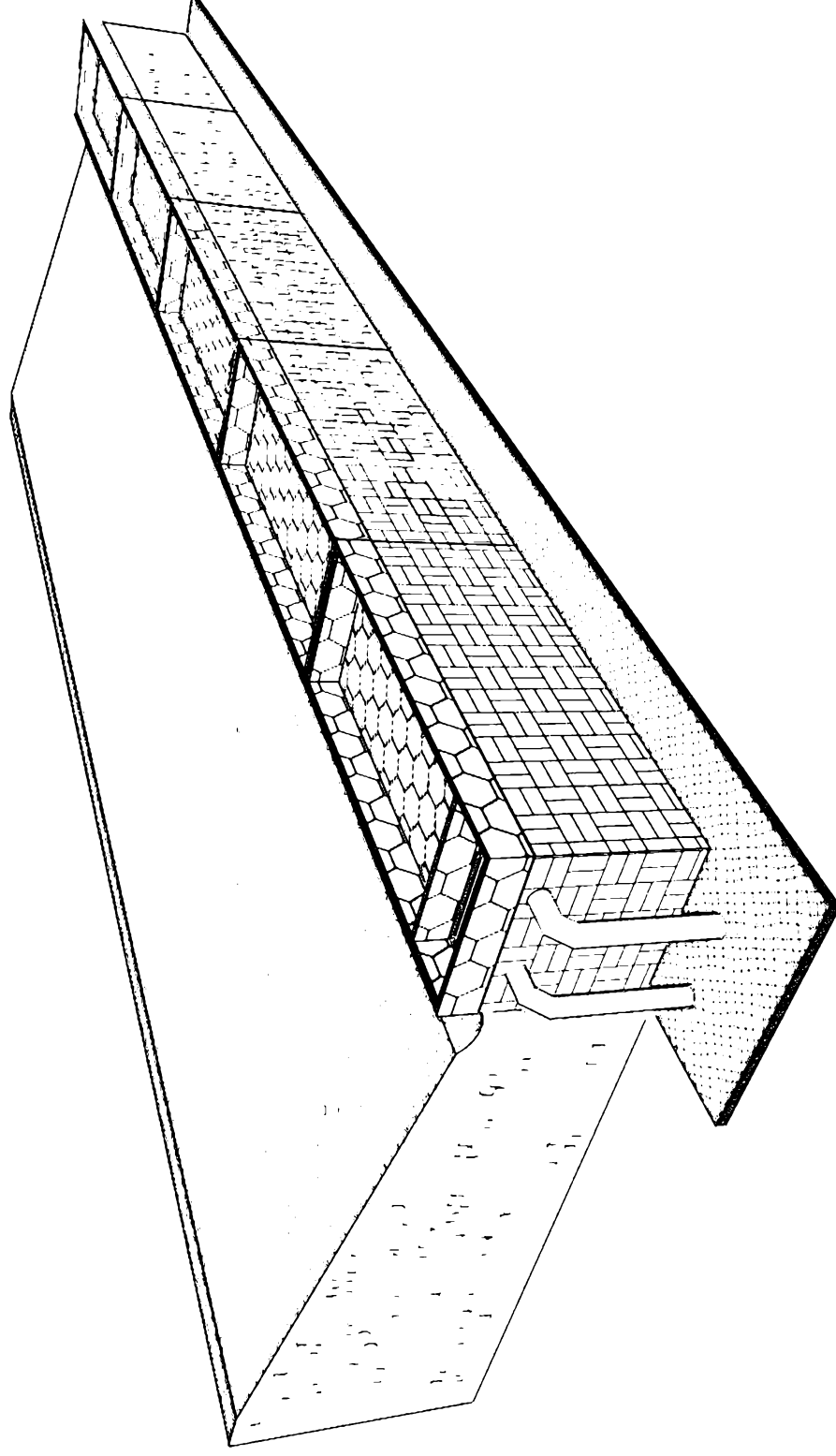


Figure 7

7/18

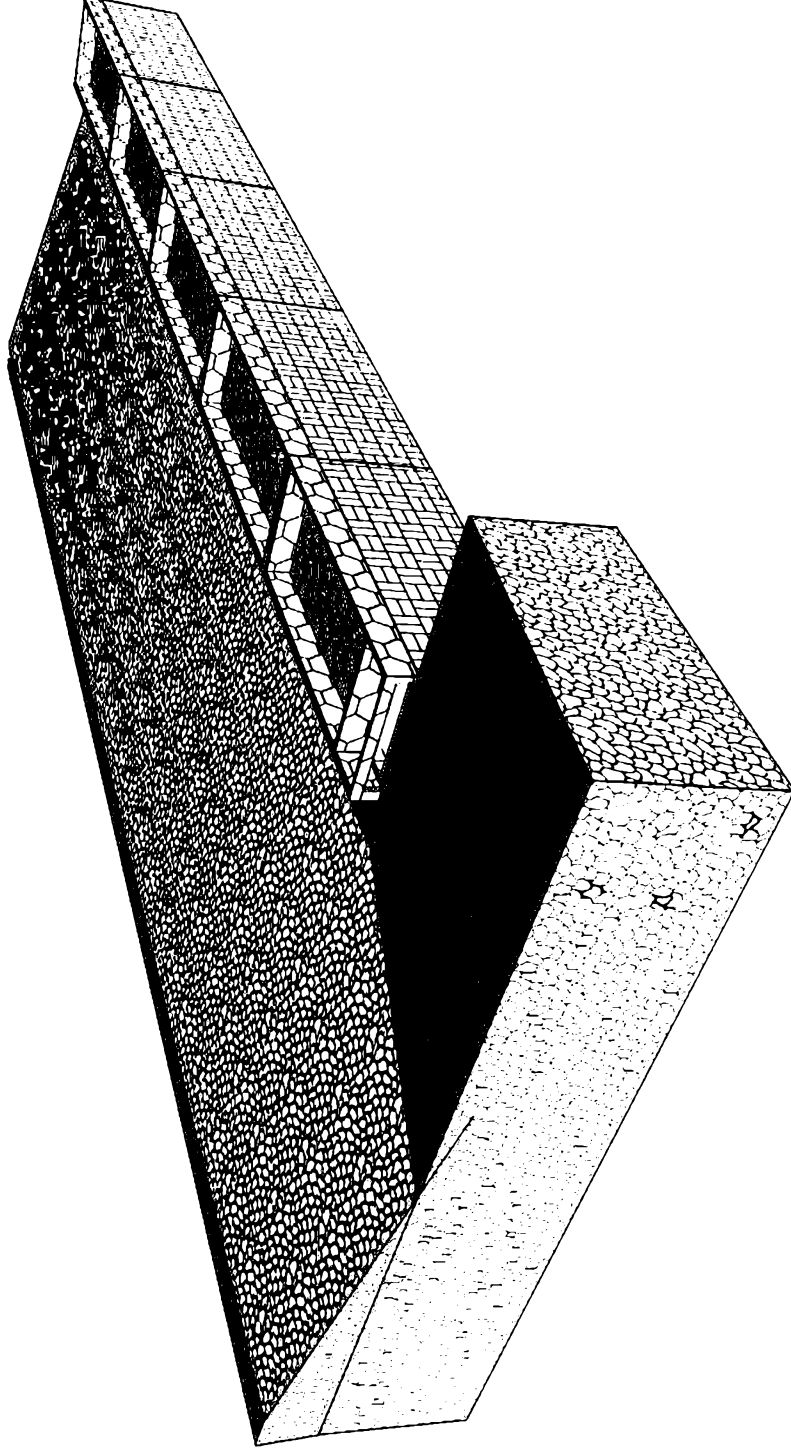


Figure 8

8/18

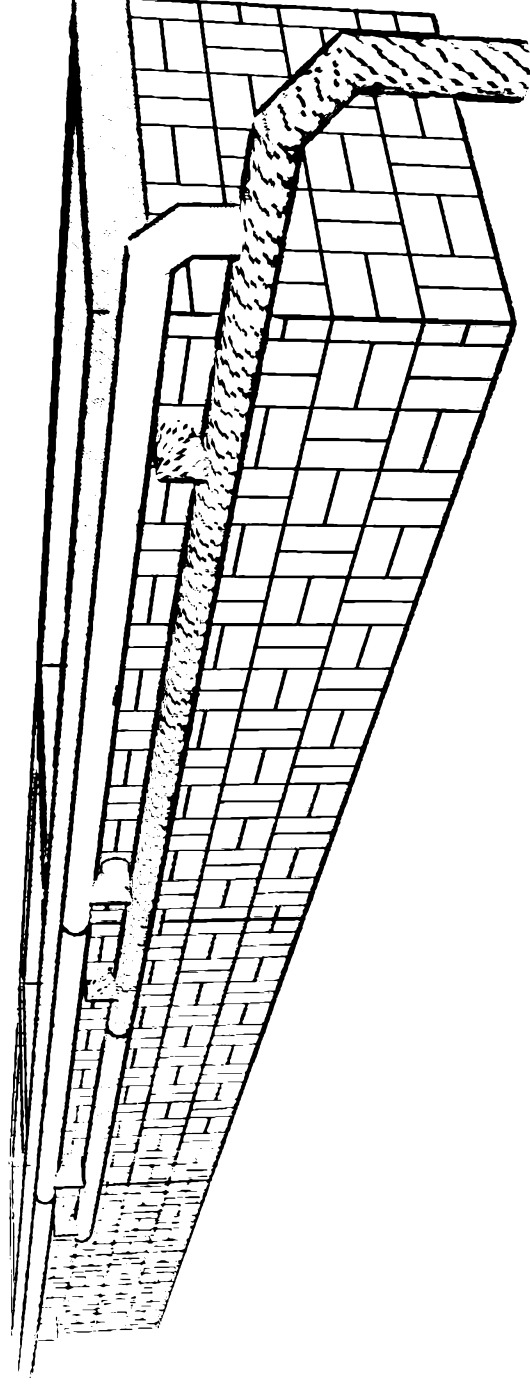


Figure 10

9/18

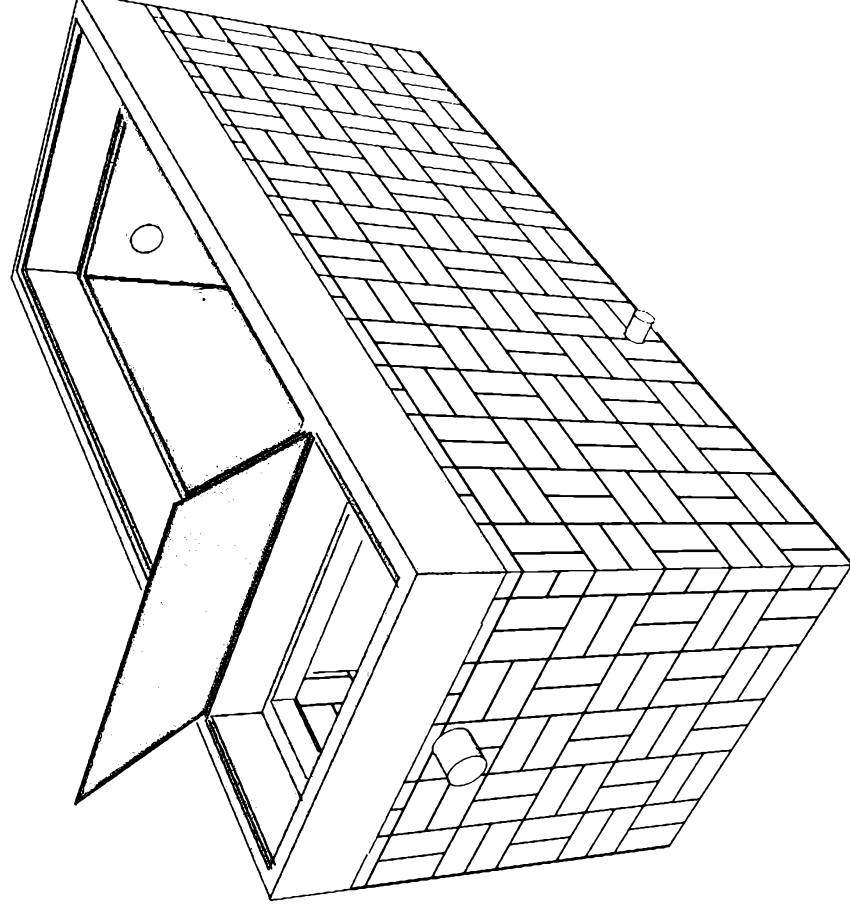


Figure 11

10/18

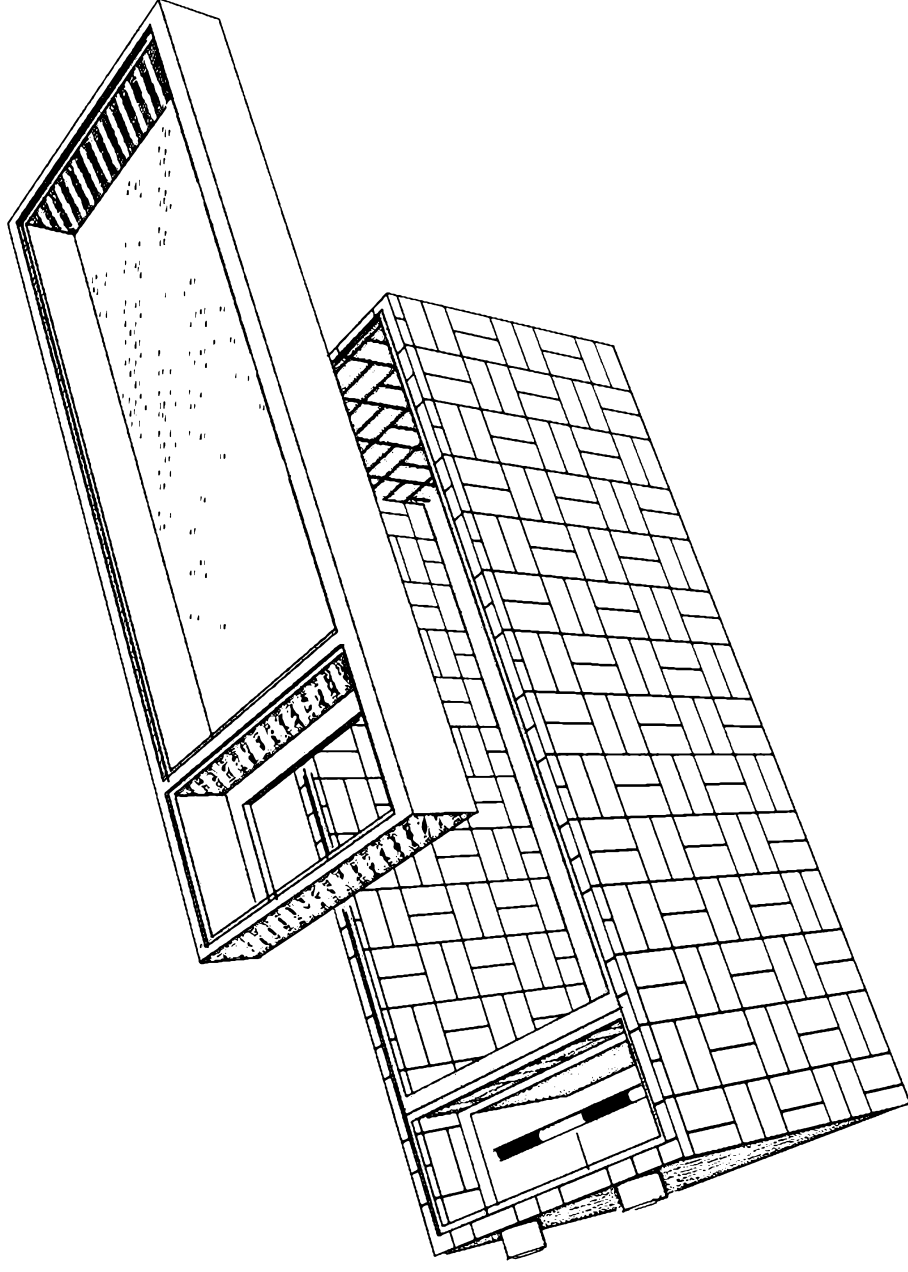


Figure 12

11/18

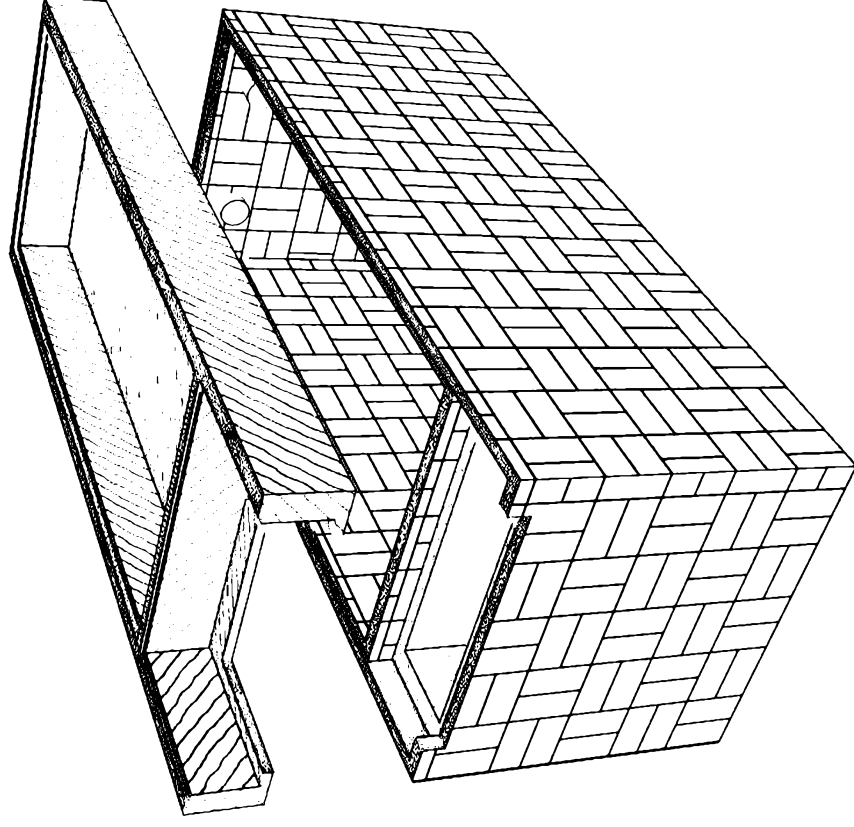


Figure 13

12/18

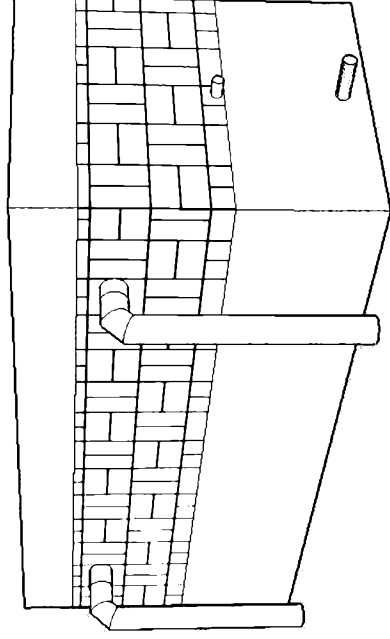


Figure 14

13/18

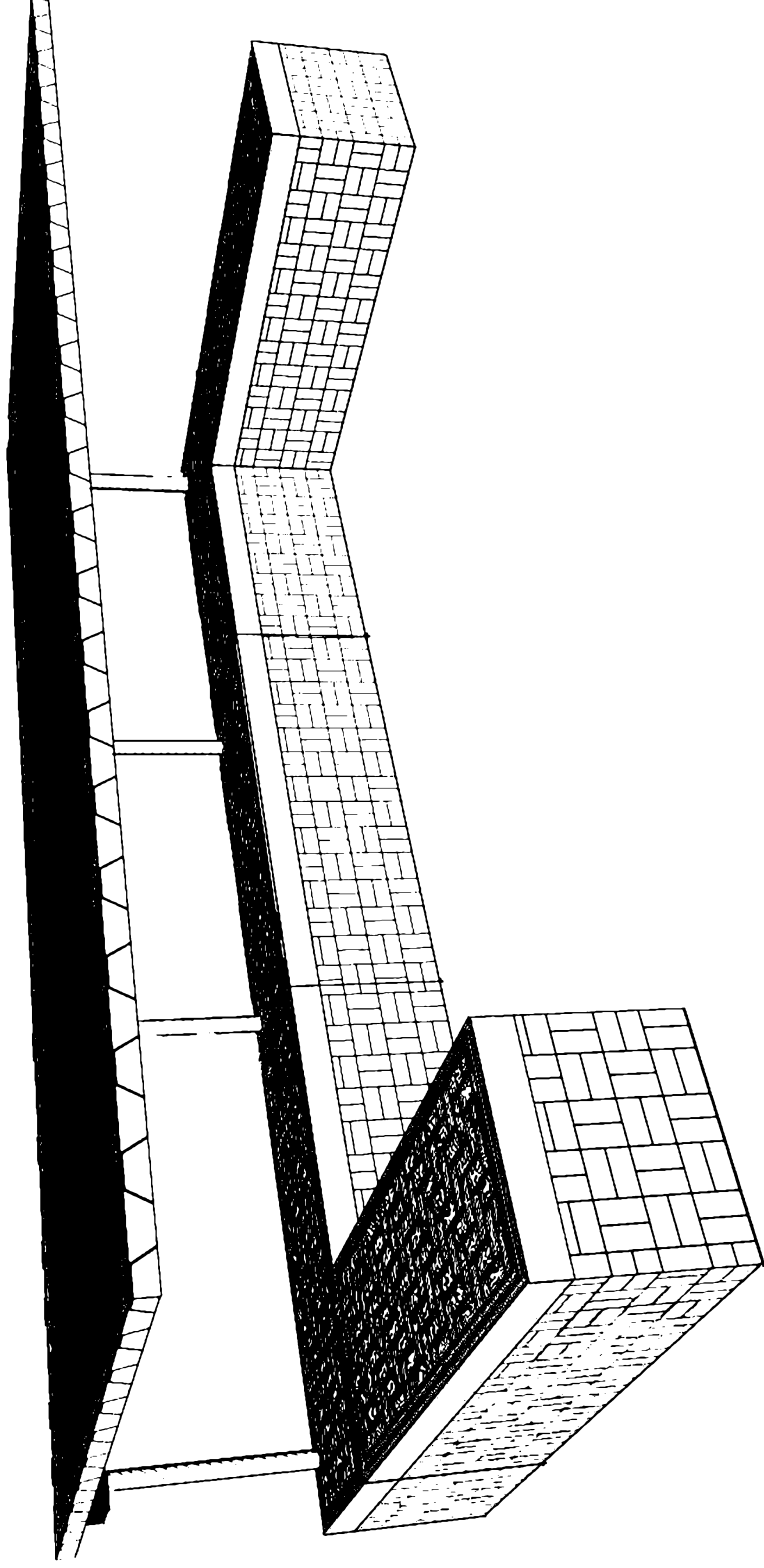


Figure 15

14/18

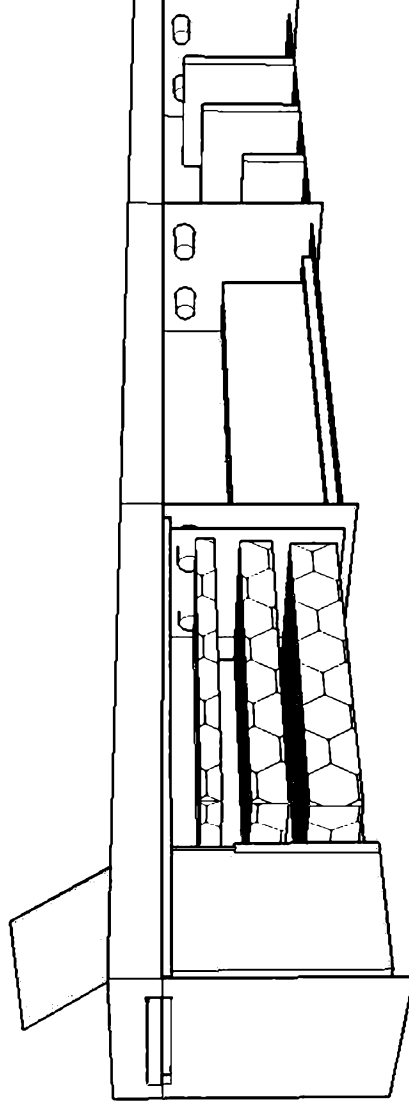


Figure 16a

15/18

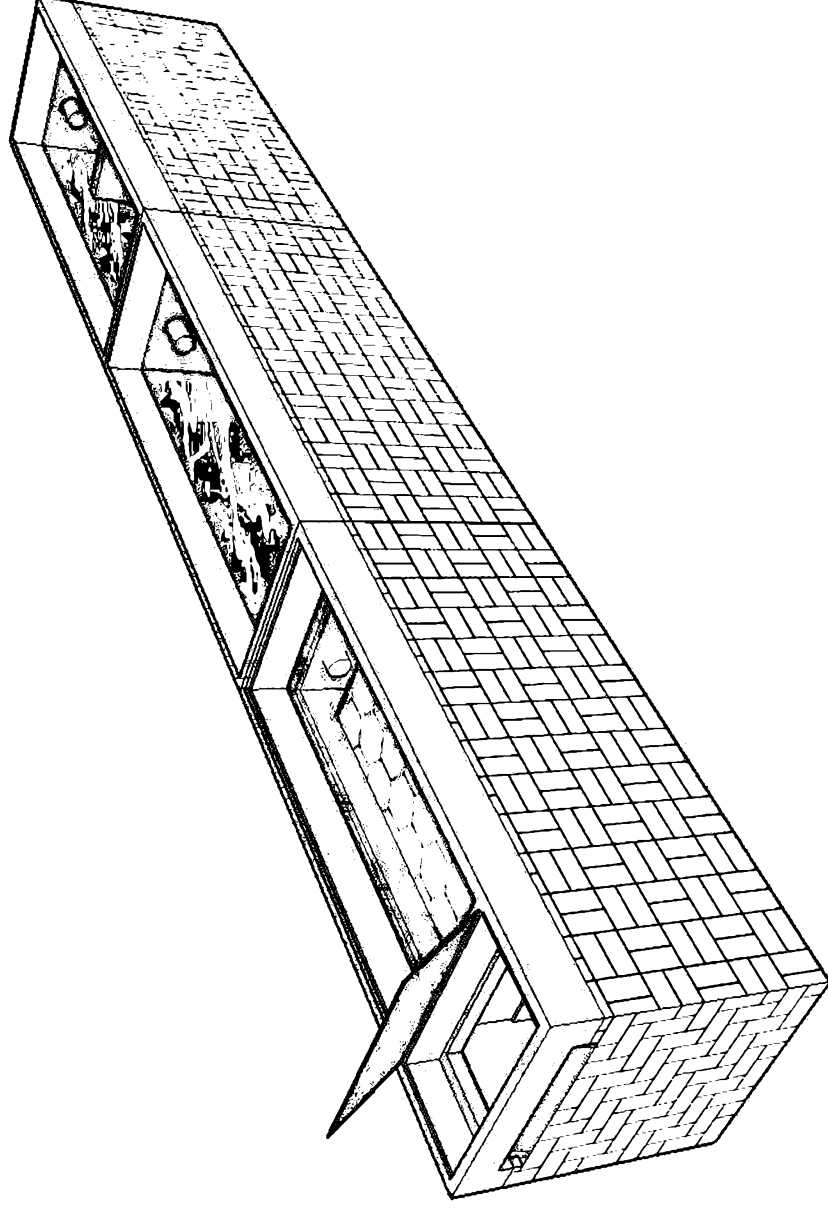


Figure 16b

16/18

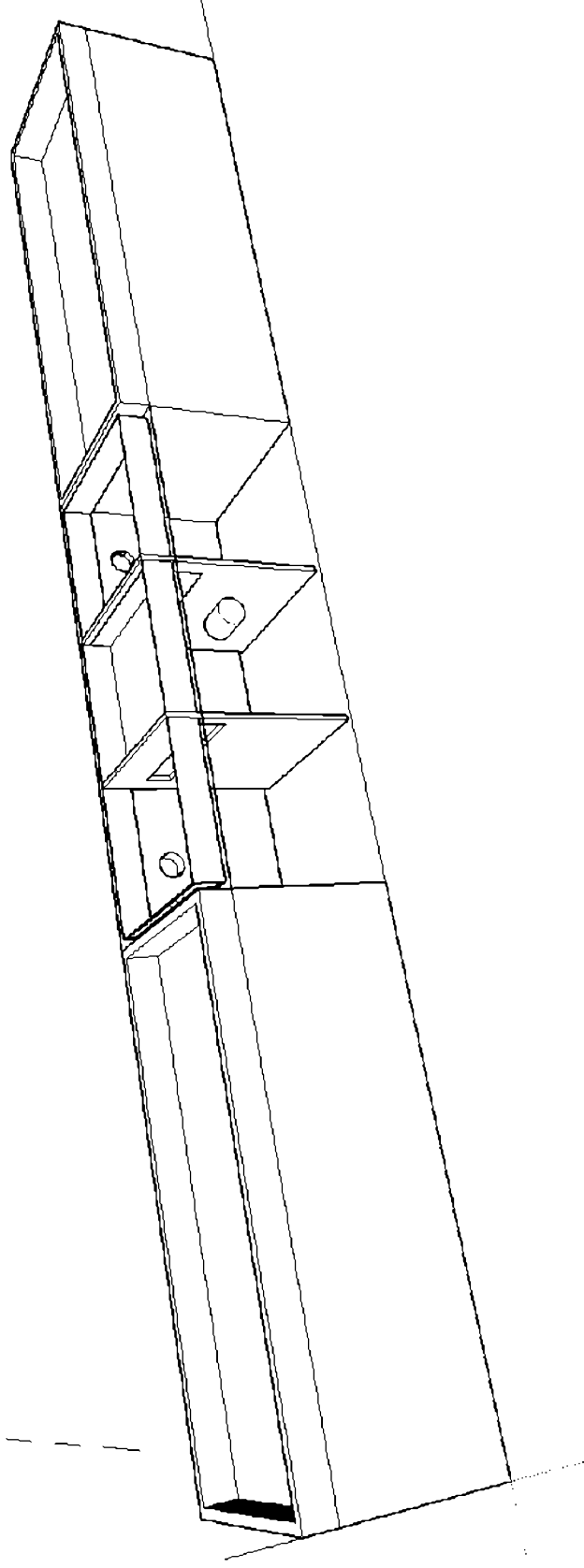


Figure 17

17/18

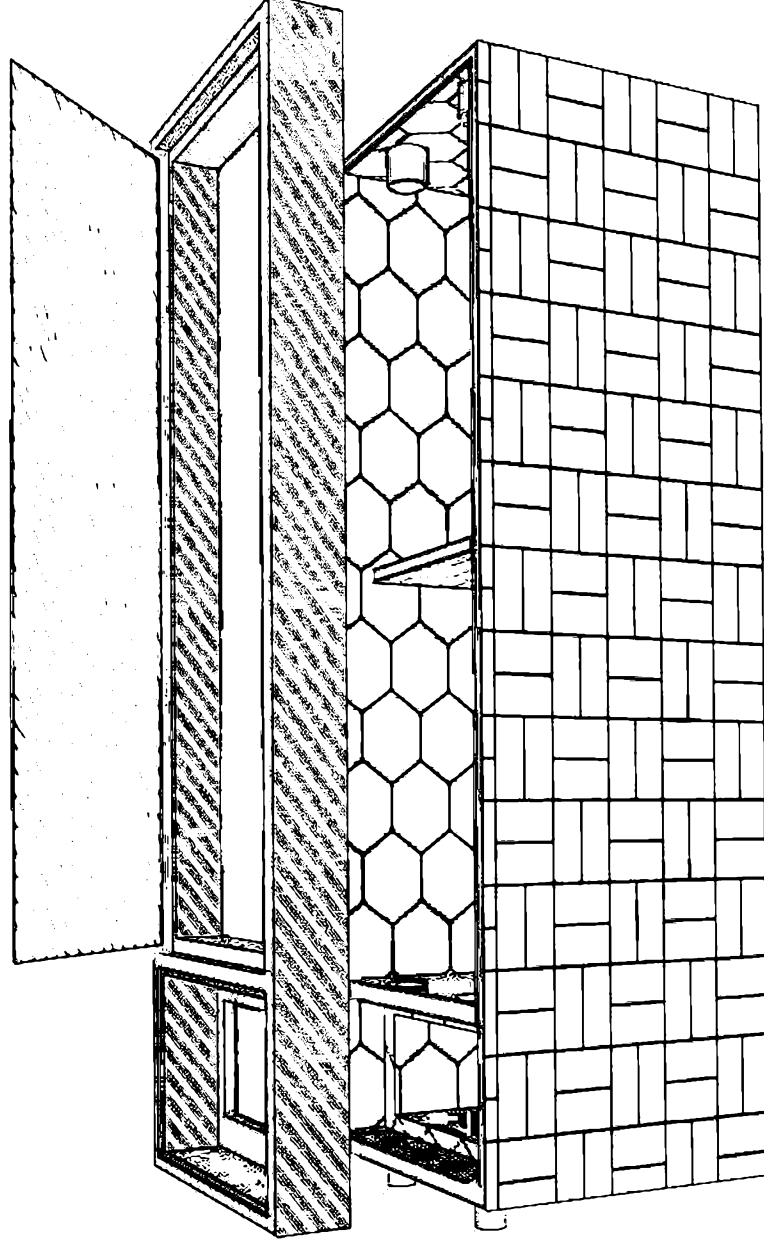


Figure 18

18/18

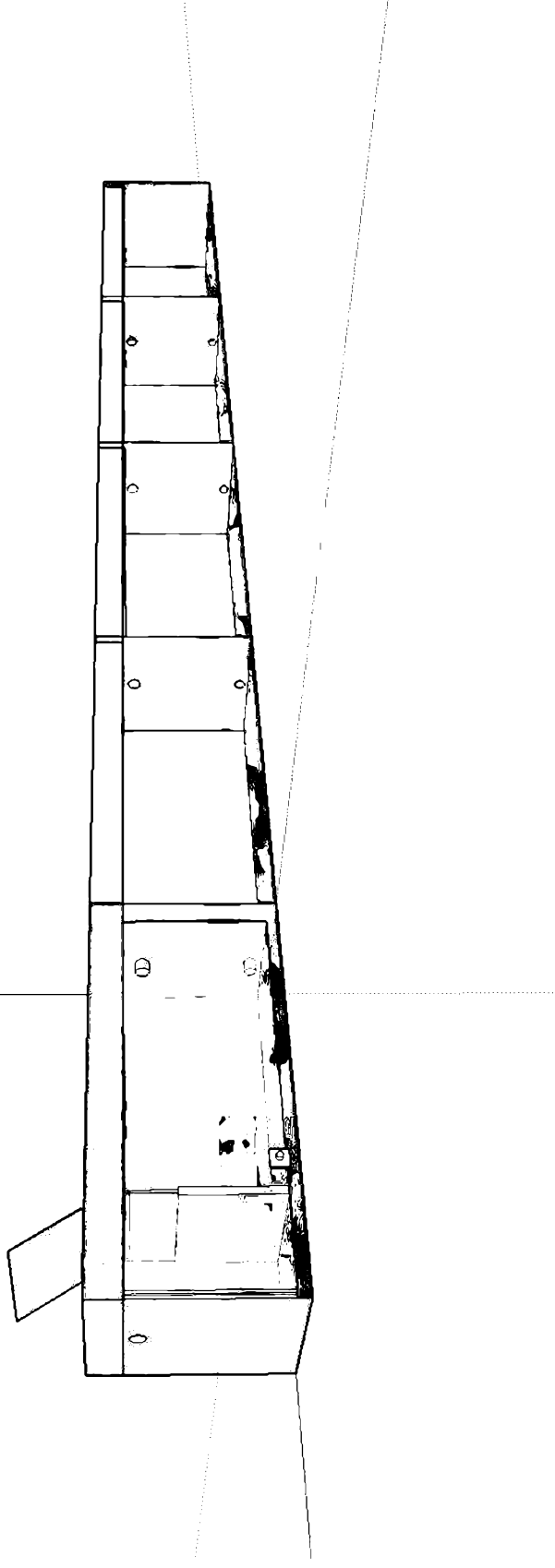


Figure 19