

**MINIMUM SPECIFICATION FOR RAINWATER HARVESTING EQUIPMENT**

**The receiving of this specification does not imply approval of a grant application.** However, if written approval is issued, then this specification becomes part of the contract between the applicant and the Department of Agriculture and Food.

This is a minimum specification. Where the word “SHALL” is used, then that standard (at least) **must** be followed in grant-aided buildings. Where a procedure is “RECOMMENDED”, this is advice only on good practice.

Note that all references to other Department Specifications are to the current edition of that specification [available on the Department of Agriculture, Fisheries and Food website ([www.agriculture.gov.ie](http://www.agriculture.gov.ie)) under Building Specifications]. Similarly, references to Standards are to the current edition of the Irish, British or European Standard, as appropriate.

This specification covers the layout and requirements for rainwater harvesting systems. For the design and construction of reinforced concrete tanks, Department Specification ‘S123: Minimum Specification for Bovine Livestock Units and Reinforced tanks’ shall be read and followed alongside this specification.

However, if other structural designs are used, then a full set of design drawings and full structural calculations shall be prepared by a chartered engineer, and given to this Department for acceptance prior to the issuing of approval for the commencement of grant-aided works.

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## **1 Safety**

### **1.1 Responsibility for Safety**

Applicants are reminded that they have a duty under the Safety, Health, and Welfare at Work Act 2005 to provide a safe working environment on the farm, including farm buildings, for all

people who may work on that farm. There is a further duty to ensure that any contractor, or person hired to do building work, provides and/or works in a safe environment during construction.

## **1.2 Safety during Construction**

**Farmer/Applicant Responsibility:** Please note that neither the Minister nor any official of the Department shall be in any way liable for any damage, loss or injury to persons, animals or property in the event of any occurrence related to the development and the applicant shall fully indemnify the Minister or any official of the Minister in relation to any such damage, loss or injury howsoever occurring during the development works.

**Dangers:** Where the applicant/farmer is undertaking any part of the above work, it is his/her responsibility to seek competent advice and to undertake all temporary work required to ensure the stability of excavations, superstructure, stanchion foundations, wall foundations, to guard against possible wind damage and to avoid any other foreseeable risk. It is also his/her responsibility to ensure that any drains, springs or surface water are diverted away from the works.

**Power lines:** Farm buildings shall not be constructed under or nearer than 10m to an overhead power supply. If advice is required, or if power lines need to be diverted, it is the applicant's responsibility to contact, in writing, the local ESB supervisor before construction commences and then to follow the ESB conditions.

**Danger to children:** It is the applicants responsibility to prevent children from playing or spending time in the vicinity of any construction work.

## **1.3 Safety Notices**

It is recommended that at least one safety notice should be put on the side of a building next to which a slurry agitation/emptying point is situated. The notice should be as close to the agitation/emptying point as possible. [Notices are available from most farm supply outlets and Teagasc].

## **1.4 Maintenance**

All farm buildings require regular maintenance to ensure the health and safety of personnel and animals. Fittings such as electrical fittings, pumps and filters, etc., should be periodically checked, and all defective items replaced.

# **2 CONCRETE SPECIFICATION**

## **2.1 Certificates**

Concrete shall be produced in a plant audited to I.S. EN 206-1: 2002 by a certified body accepted by The Department of Agriculture, Fisheries & Food (e.g. N.S.A.I., B.S.I., Q.S.R.M.C). Concrete shall not be produced on site.

A numbered certificate, signed and stamped, shall be required for all concrete delivered to site. The certificate, the "Concrete Manufacturers' Specification Certificate", is produced in triplicate. The top certificate, printed on light blue paper, shall be retained by the applicant and given to and retained by the local AES Office of the Department of Agriculture for inspection upon completion of the works.

## 2.2 Concrete

For all rainwater harvesting tanks, concrete shall be purchased on the basis of a characteristic 28 day crushing strength of  $35\text{N/mm}^2$ . Minimum cement content shall be  $300\text{ kg/m}^3$ . Slump of unplastised concrete shall not exceed 90mm, and maximum aggregate size shall be 20mm.

**The concrete shall be ordered by requesting** ‘35N concrete to be certified to the grant-aid standard of the Department of Agriculture and Food’.

If the Concrete Supplier requires further information the following shall be quoted to them:

- The concrete is to be to I.S. EN 206-1:2002: Strength Class: C28/35, 300 kg cement, maximum water cement ratio of 0.60, Exposure classes: XC4, XF3, XA1 (20 year life), Slump class: S2 (unplastised), maximum aggregate size 20mm.

If plastised concrete is desired, the slump class shall not exceed S3.

Polypropylene fibres may be incorporated into the concrete mix to improve the properties of concrete. Only fibres which have been tested and approved by National or European approval authorities may be used. The use of fibres helps to reduce plastic cracking and improve surface durability but they are not a substitute for structural reinforcement. Fibres shall be used in strict compliance with manufacturer’s instructions and shall only be added at the concrete manufacturing plant. The concrete certificate (Clause 2.1) shall clearly show the amount and type of fibre added. The mix design, compacting, and curing of fibre concrete is the same as concrete without fibre.

## 2.3 Materials

Cement used in concrete and concrete products shall be certified to IS EN 197-1, and shall bear the Irish Standard Mark, or shall be certified by NSAI to be equivalent to IS EN 197-1. All aggregates shall be to IS 5 1990. Plasticisers and other admixtures shall be to EN 934. All admixtures shall be used in strict accordance with manufacturer's instructions, and shall be added only by the concrete-mix manufacturer.

## 2.4 Tests

The Department reserves the right to require that concrete should be tested in accordance with BS1881, and that installed reinforcement may be checked by electronic or other means.

## 2.5 Compaction of Concrete

All concrete shall be compacted by either vibrating screed or poker vibrator depending upon the position of the concrete. Poor compaction leads to entrapped air, which will weaken the concrete and may cause premature failure. All concrete can be easily placed and compacted when using a vibrating screed or poker vibrator which helps ensure the concrete achieves its full strength.

## 2.6 Curing of Concrete

All concrete shall be cured by keeping it thoroughly moist for at least seven days. Wetted floor slabs and walls shall be protected by polythene sheeting, kept securely in place. Alternatively proprietary curing agents may be used in accordance with manufacturer's

instructions. When frost is a danger, straw bales shall be placed over the polythene on slabs. Concrete shall be at least 28 days old before being subjected to full load.

### **3 ELECTRICAL INSTALLATIONS**

Wiring and fittings shall be installed, and all work shall be carried out in accordance with the Second Edition of the National Rules for Electrical Installations, ET 101/1991 and Amendment A1:197, and specifically Section 705 - Electrical Installations for Agricultural and Horticultural premises. An ETCI completion certificate shall be required, signed by the Electrical Contractor(s) or a person duly authorised to act on his/her behalf to certify that the electrical installation has been constructed and/or has been tested according to the National rules of Electrical Installations and has been found to be satisfactory. An associate certificate, specifically for agricultural work, the "Supplementary Agricultural Certification Form" shall also be signed by the Electrical Contractors or authorised persons and the number of the main ETCI completion Certificate clearly marked on it. If no valid numbered ETCI Certificate is available for the completed installation, then the Electrical Contractor shall complete a new numbered ETCI Certificate indicating that the new installation has been tested for safety and compliance, and note that number on the Supplementary Form. The signed printed "Supplementary Agricultural Certification Form" together with a copy of the ETCI Completion Certificate shall be given to the Department before grant-aid can be finally certified.

### **4 Planning Permission**

All rainwater harvesting tanks require planning permission. There are no exemptions for rainwater harvesting tanks at present.

### **5 General Design of Rainwater Harvesting Systems**

A rainwater harvesting system comprises of collection, filtering and storage of rainwater. The further treatment of the collected rainwater is optional.

The basic requirements for any rainwater treatment system is well maintained clean gutters, directing the rainwater to a suitably sized and constructed holding tank from where the water is distributed to its final usage point.

Components of Rainwater harvesting system:

- 1) Roofed area to collect rainwater.
- 2) Clean gutters in good condition to collect rainwater from roof.
- 3) Rainwater down pipes in good condition.
- 4) Filter to remove debris (leaves, moss etc) from rainwater.
- 5) Covered drains to direct rainwater from gutters to storage tank, where required.
- 6) Sump tank and sump pump, where required.
- 7) Rainwater storage tank with calmed inlet and overflow. The tank shall have a solid cover.
- 8) Rainwater treatment system (optional).

Only rainwater from roofs of buildings shall be collected for harvesting.

It should be noted that unless the water is treated it will not be suitable for use as drinking water for livestock or irrigation of horticultural crops or for the washing of milking parlours as this water needs to be of potable standard (see clause 8).

## **6 Rainwater Storage Tanks**

### **6.1 General Design**

Rainwater **shall not be** collected from asbestos-cement roofs. It may be collected from tiled, metal, fibre-cement, glass or plastic / polythene roofs.

The tanks shall be constructed in compliance with specification S.123 or be proprietary purchased tanks listed in S.123Y, S.123Z, S.122 or S.171A. Tanks may be either above or below ground.

All tanks shall be covered with a solid cover that prevents the ingress of any dirt into the tank. Floating covers shall not be used. Under no circumstances may a tank for rainwater collection be left open. All tanks shall have screened ventilation fitted into the lids to prevent contamination of the water.

All tanks shall be fitted with a proprietary calmed inlet to prevent the disturbance of any sediment at the bottom of the tank.

Where feasible, a floating extraction point from the tank shall be used, which is approximately 100 mm to 150 mm below the surface of the water. If floating extraction is not practicable, a fixed extraction point may be used which shall be positioned between 150 mm and 200mm above the base of the tank.

All tanks, whether used separately or connected to each other in order to create greater capacity, shall avoid stagnation, e.g. by ensuring that pipework connections allow the through-flow of water.

In cases where a mains water top-up is attached to the tank, it shall be installed with suitable back-flow protection. The back-flow protection shall have category 5 protection (an air gap, see I.S. EN 1717: 2000 Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow) such as an AA type air gap conforming to I.S. EN 13076: 2003 Devices to prevent pollution by backflow of potable water - unrestricted air gap, or an AB type air gap conforming to I.S. EN 13077: 2008 Devices to prevent pollution by backflow of potable water - Air gap with non-circular overflow, fitted at the potable water top up point.

All tanks shall be fitted with an overflow outlet attached to a suitable clean water drainage system to allow water to discharge during storm events. The overflow shall prevent any backflow and be secure against any vermin entering the system. The flow capacity of the overflow shall be equal to, or greater than, the capacity of the inlet pipe. Best practice design will allow for overflow of the main tank at least twice a year to remove build-up of floating sediment.

A barrier, minimum of 1.2m high and minimum of 900mm from the tank, shall be constructed around all over-ground tanks that are not constructed from mass concrete, so as to prevent accidental damage from occurring to the tank.

## 6.2 Tank Sizing.

The storage volume of the rainwater harvesting tank shall be of sufficient capacity to hold between a minimum of 7 days and a maximum of 18 days rainfall from the collection area. The capacity shall be based on the average annual rainfall for the location of the tank, the size of the collection area and the demand on the harvested water.

The volume of collectable rainwater over the duration of a year is determined by the collection area, amount of rainfall and a yield coefficient. The yield coefficient is determined by the losses from the filter and losses from the roof material.

The yield coefficient for pitched roofs with profiled metal sheeting is 0.9 and the yield coefficient for self cleaning filters is 0.9. This allows for a maximum proportion of rain collectable of 81%. For tiled roofs the yield coefficient is 0.8, giving a collectable volume of only 72%.

Rainwater filters lose approximately 10% of the water passing through them to keep the filter clean and remove debris. This lost water shall be directed through the existing clean water disposal system.

The annual rainfall value for any location in the country can be obtained from Met Éireann ([www.met.ie](http://www.met.ie)). As a guide Figure 1 shows a map of the variation in rainfall amounts across Ireland (Met Éireann, 2011).

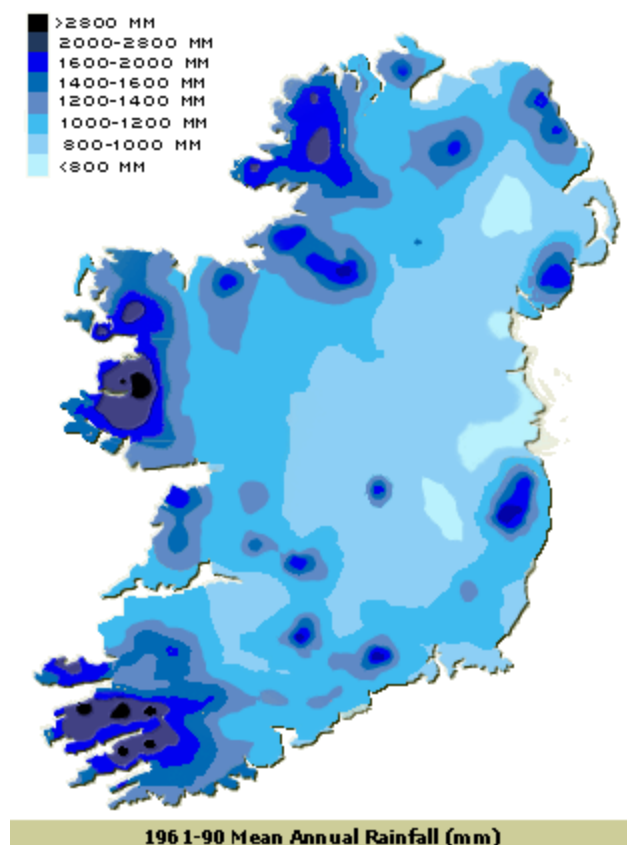


Figure1: Mean annual rainfall over Ireland as supplied by Met Éireann. Exact figures for a given location may be obtained directly from Met Éireann.

To calculate the potential collectable rainwater the following equation should be used:

$$W = \frac{A \times P \times e}{365}$$

Where:

W = Average daily Collectable rainwater (m<sup>3</sup>)

A = Roof area (m<sup>2</sup>)

P = annual Rainfall (m)

e = Yield coefficient

For example:

For a roof area of 1000m<sup>2</sup>, with an annual rainfall of 1100mm the maximum daily collectable rainwater is:

$$= (1000 \times 1.1 \times 0.81) / 365 = 2.44\text{m}^3 \text{ or } 2440 \text{ litres.}$$

So the minimum tank size required for this unit is 2440 x 7 = 17,080 litres and the maximum tank size is 43,920 litres. The actual size of the tank installed depends upon the water demand. In cases where demand is greater than supply, then the tank size shall be towards the shorter storage period. There is no value in constructing a large tank to hold 18 days rainfall if the rainwater supply is only half or less of the actual demand.

## 7 Filters

All rainwater harvesting systems shall have filters installed to filter any debris from the rainwater before it enters the rainwater storage tank. Filters shall preferably be installed on the rainwater downpipes, but in any case shall be installed before the rainwater storage tank.

All filters used in rainwater harvesting systems shall be proprietary self-cleaning filters. The use of home-made filters is not permitted. It is important that filters are sized for the correct roof area that rainwater is being collected from. The rainwater used for “self-cleaning” the filters shall be directed into the clean water drainage system. Under no circumstances may this water be allowed to flow onto a dirty yard.

Filters shall be sized for through flow of rainwater in accordance with the manufacturer’s instructions.

The required level of filtration is dependant upon the end use of the harvested water and shall be decided in consultation with the filter manufacturer / supplier.

## 8 Water treatment

### 8.1 General

Treatment of the collected rainwater is optional, however, it should be noted that unless the rainwater is treated it will not be of potable standard. As such this means that it cannot be used for purposes such as washing the milking machine or bulk milk tanks on a dairy farm, for feeding to lactating cows or on crops where the water quality might have an effect on the quality of the final product as this water needs to be of potable standard as prescribed in the drinking water regulations.

The drinking water regulations (S.I. 278 of 2007 (European Communities (Drinking water) (No. 2) Regulations 2007) definition of water for human consumption includes: “all water used in any food production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption, unless the supervisory authority is satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form”.

It is important that any treatment system installed is maintained in accordance with the manufacturer’s instructions as otherwise the system may not be achieving the required level of treatment.

## 8.2 UV Treatment

UV treatment systems shall be sized, installed and maintained in accordance with the manufacturer’s recommendations for the intended use of the harvested rainwater.

## 8.3 Chlorination treatment

Chlorination treatment systems shall be sized, installed and maintained in accordance with the manufacturer’s recommendations for the intended use of the harvested rainwater.

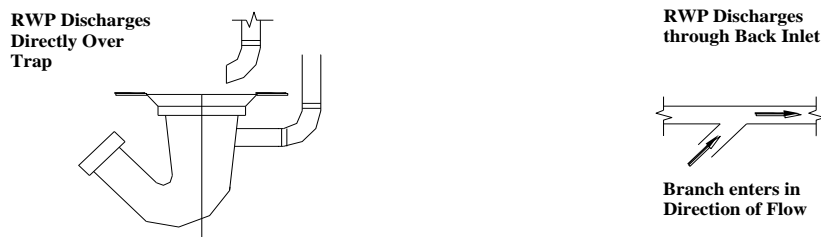
# 9 Gutters and Drains

## 9.1 Gutters

Rainwater shall be collected from all roofs by leak-proof gutters or valleys, discharging directly or through hopper heads to rainwater downpipes which discharge over covered gully traps or through back inlet gully traps to piped drains (see Figure 2). Down-pipes shall be suitably protected against damage. Gutters and R.W. downpipes shall be supported at not more than 2m centres and at all outlets and angles.

The following table gives guidance on the area of roof drained by various sized gutters dependant upon the location of the rainwater downpipes.

<b>Gutter Diameter (mm)</b>	<b>Area Drained (m<sup>2</sup>) with 75mm downpipe at end of run</b>	<b>Area Drained (m<sup>2</sup>) with 100mm downpipe in centre of run</b>
110	90	113
125	150	188
150	220	275



**Figure 2 RWP Discharge**

## 9.2 Drains

### 9.2.1 Capacity of Drains

The capacity of drains shall be capable of carrying the run-off from a storm of at least 25mm per hour rainfall intensity. The following table gives the areas that can be drained by various pipe sizes for defined slopes.

Drain Diameter (mm)	Fall	Area Drained (m <sup>2</sup> )
100	1 in 60	1,500
100	1 in 100	1,100
150	1 in 100	3,000
150	1 in 150	2,500
225	1 in 150	6,500
225	1 in 200	5,800

### 9.2.2 Lay-Out of Drains

All drains shall be laid in straight lines from point to point with inspection chambers (manholes as per clause 9.3.1) at all changes in direction. The maximum distance between manholes in straight lines shall be 90m.

Where rainwater tanks are below ground the drains may be connected directly to the calmed inlet of the storage tank. Where tanks are situated above ground, or underground but above the collection point / drains, a sump tank will need to be provided, fitted with a sump pump to transfer the rainwater to the storage tank.

### 9.2.3 Laying Drains

The available gradient of drains shall be ascertained by measuring the distance along the proposed line of the drain from the lowest collection point to the rainwater collection sump and obtaining the difference in level between the pipe inverts at these points. As far as possible all drains shall have a regular fall to the sump.

The maximum fall in clean water drains shall be 1 in 25. The recommended minimum falls are as follows:

<b>Drain Diameter (mm)</b>	<b>Minimum Fall</b>
100	1 in 100
150	1 in 150
225	1 in 200

Where a pipeline is laid in steep sloping ground it will be necessary to provide a back drop manhole as specified in clause 9.3.3.

Pipe laying shall be commenced at the rainwater collection sump. The trench shall not be greater in width than the pipe outside diameter plus 300mm. Where necessary the trench down to a point 150mm over the top of the pipe may be of greater width.

Pipes shall be laid on a 100mm thick cushion of clay or sand. All pipe jointing shall be in accordance with manufacturer's instructions. After the pipes and fittings are laid true to line, level and gradient and firmly supported throughout their full length, the side fill material shall be placed in layers of 100mm and firmly compacted up to 100mm over the top of the pipes. Thereafter the remainder of the backfill shall be placed and compacted in 300mm layers with particular care taken under roads and paved yards to avoid any subsidence.

Concrete pipes shall be to IS 6: 1974 and uPVC pipes to IS 424: 1990.

#### **9.2.4 Protection of Drains in Special Cases**

Because of problems with falls in existing farmyards it may be necessary to lay drains above or at ground level. In such cases the pipes shall be totally encased in 150mm of concrete. uPVC pipes shall be wrapped with plastic sheeting before concrete is poured.

Shallow pipelines under roads, with less than 0.9m cover, shall be encased in concrete.

#### **9.2.5 Clear Pipes and Channels**

Special care shall be taken to remove all mortar, earth or other material out of pipes and channels, and to keep them clean at all times.

### **9.3 MANHOLES AND INSPECTION CHAMBERS**

#### **9.3.1 Manholes**

Manholes shall be constructed with mass concrete walls not less than 150mm thick to depths up to 600mm and 225mm walls for greater depths. The manhole base shall be of 150mm thick concrete 300mm wider than the outside walls, see Figure 3. Smooth shuttering and well-compacted concrete shall be used for mass concrete walls to ensure smooth watertight finish. Alternatively, precast manholes may be used.

Manhole dimensions shall be as follows:

<b>Depth to Invert (m)</b>	<b>Length (m)</b>	<b>Width (m)</b>
0.6	0.6	0.45
0.6 to 0.9	0.75	0.6
0.9 to 1.8	1.05	0.75

Each manhole shall have a heavy duty cover and frame installed. It shall be level with the surrounding surface.

Manholes as part of a rainwater harvesting system shall not be constructed in a dirty yard area.

### 9.3.2 Manhole Channels

The manhole channel shall be of half round pipe section, equal in diameter to the largest inlet pipe, bedded in cement mortar and extending the full length of the manhole. Side connections shall discharge over the edge of the main channel in the direction of flow as shown in Figure 3.

### 9.3.3 Backdrop Manhole

Where a backdrop manhole is required, the manhole shall be constructed as specified in clause 9.3.1. The backdrop shall be formed on the upstream side of the manhole as shown in Figure 4. All backdrop manholes shall be fitted with a heavy duty cover.

### 9.3.4 Sump Manhole

In cases where an over-ground tank or underground but above the collection point / drains, a sump shall be constructed at the end of the drains for the installation of a pump to transfer the rainwater into the main collection tank.

Where required a sump manhole shall be constructed in accordance with Figure 5. Such sump manholes shall be constructed with an overflow facility connected to the clean water drainage system. The sump shall be at least 900mm deep to facilitate the installation of a submersible pump to transfer the rainwater to the storage tank. The sump shall be located as close as possible to the main storage tank. All sump manholes shall be fitted with a heavy duty cover.

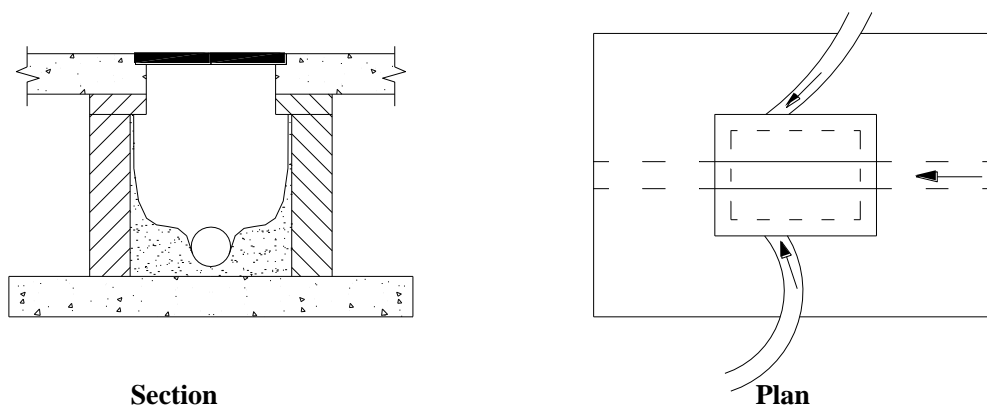
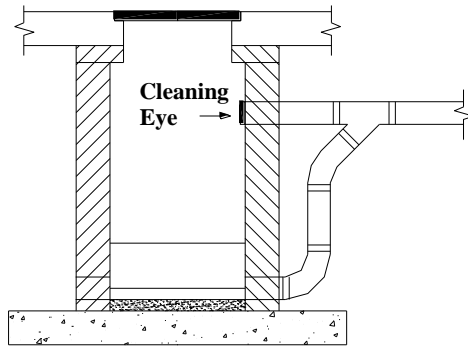
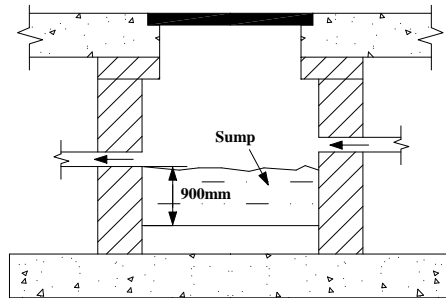


Figure 3 - Interception Chambers -



**Figure 4 Backdrop Manhole**



**Figure 5 Sump manhole**

## 10 Certificates

The following certificates shall be collected, and given to the Department before grant-aid can be paid:

- (1) "Concrete" Certificate (Clause 2.1)
- (2) "Electrical" Certificate (Clause 3)
- (2) "Protection of Structural Steel" Certificate (where appropriate)

## 11 Related Department Specifications

The current edition of the specifications listed below shall also be followed as required:-

- 1) S.123: Minimum Specification for Bovine Livestock Units and Reinforced Concrete Tanks.
- 2) S.123Y: Accepted Pre-Cast Tanks For Grant-Aid.
- 3) S.123Z: Accepted Pre-Cast Concrete Tank Walls For Grant-Aid.
- 4) S.129: Minimum Specification For Farmyard Drainage, Concrete Yards And Roads.
- 5) S.171A: Accepted Rainwater Harvesting Tanks.

Copies of these and other relevant Department specifications are available on the department website at: [www.agriculture.gov.ie](http://www.agriculture.gov.ie) under 'Building Specifications' or by contacting the one of the local offices of the Department of Agriculture, Fisheries and Food.