

**BY JOHN MASON AND STAFF OF ACS DISTANCE EDUCATION** 

# CONTENTS

Credits	4
CHAPTER 1 SCOPE AND NATURE OF WATER MANAGEMENT	5
What needs to be waterproofed in the backyard?	6
Materials for waterproofing	10
Why drainage is important	15
CHAPTER 2 WATER MOVEMENT IN SOILS	16
The lateral movement of water	
CHAPTER 3 UNDERSTANDING CAPILLARY ACTION	22
CHAPTER 4 MANAGING WATER AT THE SOURCE	_24
Rainfall	25
Rainwater harvesting	
Stored water – dams, reservoirs, tanks	
Diverting storm water	29
The water table	30
Leaks	
CHAPTER 5 MANAGING SURFACE DRAINAGE	36
Types of surface drainage systems	
CHAPTER 6 MANAGING SUB-SURFACE DRAINAGE	_44
Improving soil drainage	44
First decision: subsurface or surface drainage?	45
Types of subsurface drains	
The water outlet	
Gradients	

Layout of drains	
Laying an agricultural (agi) drain	48
Distance between drainage pipes	48
Depth of drains	
Maintenance	
CHAPTER 7 STORM DRAINAGE	50
Storm runoff	
Inlets	
Manholes	
Swales	
Storm water management	
FURTHER READING AND STUDY	
More ebooks available	
Courses available	57

# CREDITS

### © Copyright: John Mason

#### Written by

By John Mason *Dip. Hort.Sc., Supn Cert, Adv. Cert. Mgt., FCIH, FAIH, FPLA* and staff of ACS Distance Education

#### Photos:

John Mason Stephen Mason

#### Layout

Stephen Mason

#### **Editorial Assistants/Contributors:**

John Mason Dip.Hort.Sc.FCIH, FAIH, FPLA Jacinda Cole B.Sc. Parita Shah M.Sc.Hort. Marie Beermann M.Hort.

#### Published by

ACS Distance Education

P.O. Box 2092, Nerang MDC, Queensland, Australia, 4211 admin@acs.edu.au www.acsbookshop.com

P O Box 4171, Stourbridge, DY8 2WZ, United Kingdom admin@acsedu.co.uk www.acsebooks.com

## ISBN: 978-0-6487526-9-1

The information in this book is derived from a broad cross section of resources (research, reference materials and personal experience) from the authors and editorial assistants in the academic department of ACS Distance Education. It is, to the best of our knowledge, composed as an accurate representation of what is accepted and appropriate information about the subject, at the time of publication.

The authors fully recognise that knowledge is continually changing, and awareness in all areas of study is constantly evolving. As such, we encourage the reader to recognise that nothing they read should ever be considered to be set in stone. They should always strive to broaden their perspective and deepen their understanding of a subject, and before acting upon any information or advice, should always seek to confirm the currency of that information, and the appropriateness to the situation in which they find themselves.

As such, the publisher and author do not accept any liability for actions taken by the reader based upon their reading of this book.

# CHAPTER 1 SCOPE AND NATURE OF WATER MANAGEMENT

Water is great to have in a building, a farm, park, or garden; provided it is kept where you want it. Wherever you have water, you need waterproof membranes to keep it confined. When water escapes it is going to be soaked up by the nearest absorbent material, and when that material becomes saturated, it will move on, overflowing into other places.

### When is water a problem?

- When it leaks from ponds, pipes, downpipes, guttering, drains, tanks, or anything else intended to hold it.
- When it makes the ground wet and slippery.
- When it creates moisture that causes mould to grow, fungi, algae etc to grow – making paths slippery, indoor environments unhealthy

- When it makes the soil too wet for plant growth.
- When it creates moisture where moisture can cause deterioration (e.g. Moist metal can rust, moist wood can rot, moist buildings can breed mould, wet ground can become difficult to walk or drive a vehicle on and may kill some plants).
- When it reduces access to places.



Improving drainage in a vegetable patch can be as simple as creating mounds and gullies between, and growing vegetables on the mounds.

### WHAT NEEDS TO BE WATERPROOFED IN THE BACKYARD?

### Roofs (Greenhouse, Garden Shed, Carport, Gazebo, Summer House)

There are several things that can cause leaks allowing water to enter through roofs:

- Cracked flashing Flashing are pieces of metal installed under shingles and on roof joints to create a waterproof barrier. Tar used for sealing flashing can corrode, exposing the flashing to the elements causing it to crack.
- Damaged shingles Heavy winds and rain can damage shingles.
- Improperly sealed valleys A valley is where two roof planes meet. This area is usually sloped. If it is not sealed properly, water can easily enter as it runs down the roof. This may occur where the valley has not been sealed correctly in the first place, or where it has cracked due to being stepped upon or where heavy rain or ice have caused it to erode.
- Clogged gutters Gutters are meant for draining water from the roof. When they are clogged with leaves and debris, this drainage is interrupted, causing rainwater to pool on the roof, increasing its chance to seep through cracks.
- Incorrectly sealed greenhouse roof
  When greenhouse roof panels and roof vents are not installed and

sealed correctly, water can leak into the greenhouse. This can create an overly humid environment promoting mould and mildew which can negatively affect the health of plants and people within the greenhouse.

A leaky roof can cause a range of problems:

#### Mould and Mildew

Water entering through leaks in the roof can create a humid environment inside the building which promotes the growth of fungi, such as mould and mildew. Mould may not only compromise the structural integrity of the building, it may also cause health problems for people entering the building. Certain strains of mould, such as black mould, are toxic and may cause respiratory and neural problems. Mildew can also cause health problems by triggering allergic reactions.



Poor drainage behind a brick wall can be indicated by salt deposits left behind by salty water seeping through the wall.

#### **Structural Damage**

Water entering through leaks in the roof slowly seeps down and is absorbed by building materials, such as wood and concrete. Once these materials have absorbed a certain amount of water, they begin to lose their shape and strength. Wooden frames and beams become soft and warp. Concrete walls and foundations begin to soften and crack.

Constant exposure to water can also cause the building material to decompose and rot. A wooden frame, for example, then becomes soft and spongy, reducing its ability to carry weight. If the wooden frame of the roof begins to rot, this can cause the roof to cave and collapse.

#### **Roof Damage**

Before water damage spreads to other areas of the building, the roof itself is affected. In metal roofs, water may enter into seams and bolts. This can cause rusting and deterioration of roof materials. In wooden roofs, water damage can cause the frame to deteriorate and lose its ability to hold weight. It can also cause problems with roof tiles and shingles on top of the roof.

#### **Electrical Problems**

It is well known that water and electricity do not mix. Water dripping through the roof to parts of the building with electrical wiring can cause problems. Water in electrical wiring can generate an electrical charge within the wire that can cause the fuse to blow and may inflict serious harm on anyone coming in contact with it. It can also initiate sparks which can cause the building to catch fire.

# Rooftop Gardens (eg. on a veranda)

Rooftop gardens (also called green roofs) can be constructed on pitched or flat roofs, or verandas. They consist of vegetation growing on a substrate layer containing landscaping materials and drainage. Below the substrate layer is a protective waterproofing membrane to prevent seepage of water into the building below.

The waterproofing membrane must be strong enough to support the weight of the garden and robust enough to withstand gardening chemicals and various weather conditions. It must also be flexible enough to allow expansion to accommodate thermal or physical movements of the structure.

The waterproofing membrane must furthermore be root proof. Plant roots penetrating into the waterproofing material in search for nutrients can cause damage resulting in water leakage. Synthetic waterproofing materials are generally less likely to be penetrated by plant roots than organic materials, such as Asphaltic Bitchumen which was often used for waterproofing rooftop gardens in the past.

#### **Retaining Walls**

Retaining wall materials such as concrete blocks, masonry and bricks are porous by nature, allowing water to penetrate from the adjacent soil to the interior space. Water in the wall can cause various problems, such as concrete cancer: Steel supporting rods exposed to water corrode; the steel then expands resulting in spalling (the cracking of surrounding concrete), further exposing the steel to the elements, accelerating corrosion.